Electrical World

FEBRUARY 22, 1941

FEB 24 1941

SPLICING 132-KV. "OILOSTATIC" CABLE

Tree Trimming Time is HERE...

DO IT FAST for LESS ...and SAFELY!

NOW *one* man alone spots the fast, safe Murray Crows'nest AND trims the trees—faster—much faster—than *two* men did it the old way (see small photo). Countless utilities, park commissions and municipalities trim trees this modern Crows'nest way. If you have used your Crows'nest only for lamp maintenance, give yourself a break—put it under the trees—and *marvel!* Better still—have a special fast, time-tried Crows'nest for this work. A sound investment, indeed! Metropolitan Device Corporation, Brooklyn, N. Y.

THE Crows'nest is just *one* example of the efficacy of Murray Modern Methods. The list at the left gives many other Murray Devices which have proved their worth in use, times without number. You should know all about these new-day developments — some of which — RIGHT NOW — might simplify or economize your operations. Send the coupon for full data on any or all Murray Devices.

KNOW these Devices, too!

Bridging Shells • Cable Racks • Cable Grips • Current Limiting Reactors • Disconnect Plugs • Gas Cock Seals • Malleable Strapping • Meter Boxes • Meter & Entrance Switches • Meter Seals • Meter Testing Devices • Meter Troughs • Panelboxes • Range Switches • Safety Switches • Solderless Connectors • Street Light Servicing Ladder.

COUPON BRINGS ANY FACTS YOU NEED • SEND IT NOW!

METROPOLITAN
DEVICE CORP.
Brooklyn, N. Y.

Please send printed matter on

Murray

Name

Title

Company

Address

Murray crows'nest

AMERICA'S OUTSTANDING
MAINTENANCE LADDER FOR ALL
UTILITY WORK "UP IN THE AIR"

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 67 YEARS

A. E. KNOWLTON.....Associate Editor
HENRY G. DOOLEY.....Associate Editor
G. F. WITTIG.....Statistical Editor
E. DALTON WHITE.....News Editor
CHARLES DE VORE.....Assistant Editor
E. M. GLENNON.....Assistant News Editor

BRANCH OFFICES
L. W. W. MORROW.....Western Editorial Director
D. T. BRAYMER.....Western Editor
H. S. KNOWLTON.....New England Editor
WAYNE SNOWDEN.....Pacific Coast Editor
PAUL WOOTON.....Washington Correspondent

FRANK R. INNES.....Managing Editor

S. B. WILLIAMS.....Editor

W. K. BEARD, JR.....Manager

February 22, 1941

Contents

Vol. 115, No. 8

Utility Chooses Oilostatic Cable for 132-Kv. Transmission 40
JOHN H. SCHRODER, *Public Service Electric & Gas Company*

Electrical Water Purification Builds Added Revenue 43
J. B. KLUMPP, *Consulting Engineer, Philadelphia, Pa.*

Circumstances Attending a Major Metropolitan Disturbance 45

Electrical Modernity in a Paper Mill 48
A. C. BIRD, *H. S. Ferguson & Company*

Flashboards Release Flood Like "House of Cards" 51
JULIAN WALTON, *Belton Light & Power Company*

Carrier Indicator Reports Rural Outages 52
DONNAN E. BASLER and JOHN F. ATKINSON, *Rural Electrification Administration*

Thermal Meters Guard Station Transformers 54
R. C. SLACK, *Atlantic City Electric Company*

Network Protector Operations Reduced 56
W. W. EDSON, *Boston Edison Company*
M. A. BOSTWICK, *Westinghouse Electric & Manufacturing Company*

"Shucks, Mister, We Like the Place" 58

Carter Field on Washington Events 62

News of the Week 63

Editorials ..... 39 and 60
Field Operating Practices 72
Industrial Engineering 78
New Engineering Ideas 82
Load Building 88
New Equipment 94
Manufacturing and Markets 103
News About People 106
Recent Rate Changes 114
Rural Allotments 116
Sales Opportunities 118
Letters to the Editor 123
Books Received 124
Index of Advertisements 126

McGRAW-HILL PUBLISHING COMPANY, INC.

JAMES H. McGRAW, Founder and Honorary Chairman

Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Canada, Mexico, Central and South American countries, $5 a year $8 for two years, $10 for three years. Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.
Contents copyrighted, 1941, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga. Cable Address McGRAWHILL, New York.

Publication Office
99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Jr.....President
HOWARD EHRLICH.....Executive Vice-President
MASON BRITTON.....Vice-Chairman
B. R. PUTNAM.....Treasurer
D. C. McGRAW.....Secretary
J. E. BLACKBURN, Jr.....Director of Circulation

Member A.B.P. Member A.B.C.

A McGRAW-HILL PUBLICATION

OKONITE Insulated Wires and Cables
FOR ALL ELECTRICAL NEEDS
For complete recommendations concerning any electrical wire or cable problem covering design, insulation, protective finish and installation, including jointing and terminating, consult Okonite Engineering Service. Call our nearest branch office or write direct to
THE OKONITE COMPANY
Passaic OKONITE New Jersey
Offices in principal cities

Priorities

If there is one thing American industry fears more than anything else in this defense preparation, outside perhaps of socialization, it is priorities. Nevertheless, some priorities are here and more will come.

Unlike during the first World War, priorities now are, except where acute shortages occur, what might be called subtle. The authority is there, even if incased in a velvet glove.

Strangely enough, however, and this view is prevalent among those in Washington responsible for the direction of our defense production efforts, there should be little or no need for priorities because the industrial plant of America is large enough to supply all of our needs. What, then, is causing the shortages that bring about priorities?

Defense officials recognize that a program of the size of this rearmament effort is bound to cause some dislocations, but they are confident that the trouble has been heightened through hoarding. This is a common failing among business men, only this time it is not due to any fear of advancing prices so much as it is to fear that the supplies or equipment will not be available when needed. How much of the jam is caused by this ordering of goods not immediately needed is not known, but the condition does exist.

Business men who know their own problems in getting their work out ought to be able to see how much easier it would be for everybody if only pressing orders were placed now. The defense officials have no hesitancy in saying that if business men will take this viewpoint and co-operate to cut down hoarding and pyramiding this defense load can be picked up without seriously dislocating normal peacetime operations.

Fortunately, it is not possible to hoard kilowatt-hours. This is one raw material that is purchased only as needed and in the exact amount. This is one reason, perhaps, why utilities are able always to be ready and to show an ample reserve.

Utilities, therefore, should have little difficulty in co-operating with those in charge of the defense program in the matter of timely purchasing. If prices are to be kept under control, and indications are definitely in that direction, there is no necessity for utility hoarding or ordering too far in the future. For large equipments it is always possible to secure a place in the production schedule so that delivery will be made at the time needed. To order some equipments for current delivery when it will be another three or four years before they will be needed is merely to invite the imposition of priorities.

National defense production is not in the hands of politicians. It is in the hands of business men of fine reputation and integrity. When they ask for co-operation from business to prevent or reduce the necessity for priorities they should have the co-operation of every business man who still likes to run his own business.

Utility Chooses Oilostatic Cable for 132-Kv. Transmission

Simplicity outstanding characteristic of system, selected for economic and engineering advantages over alternative methods — Three single-phase cables, in 8-in. steel pipe, are surrounded by oil under 200 lb. pressure

JOHN H. SCHRODER, Public Service Electric & Gas Company*

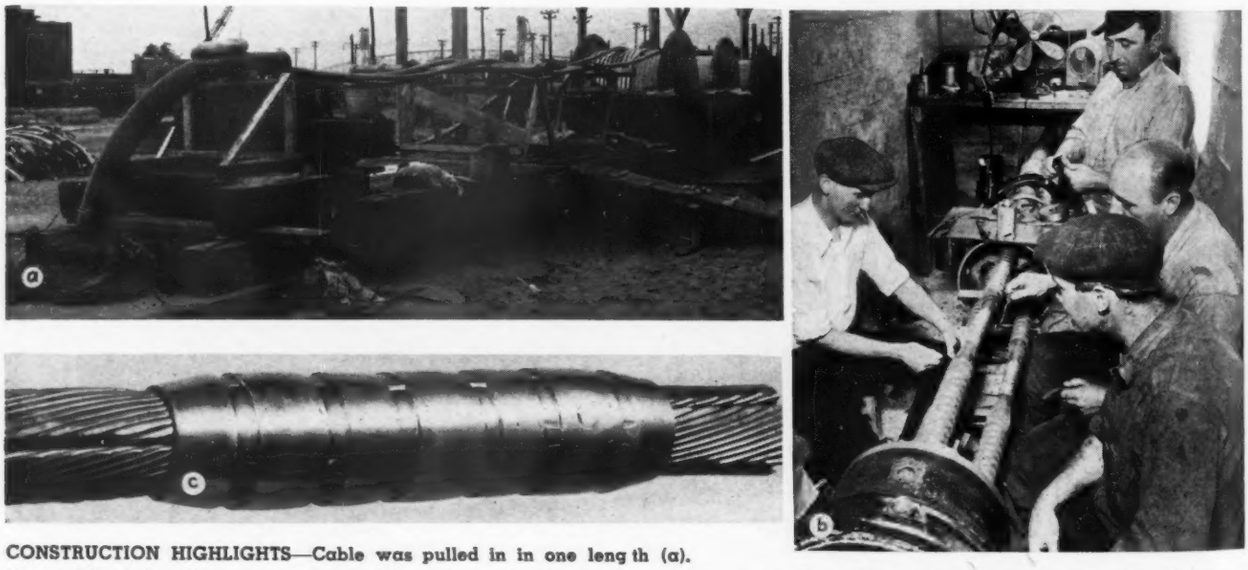
SIMPLICITY is the keynote of the two-circuit, three-phase, 132-kv. "Oilostatic" cable installation at Burlington generating station of Public Service Electric & Gas Company, completed with only two manholes per circuit and without a soldered joint in the double run from the three delta - wye - connected, 13.8-138-kv., 39,000-kva. transformers adjoining the generating plant to the switching station, nearly 1,500 ft. away.

Two circuits were required, since the transformers are equipped with double windings. Each winding operates on a separate circuit, but arrangements are provided so that both windings may be operated on either circuit. Between manholes—a distance of about 1,200 ft.—the Oilostatic cable is run in 8-in. outside diameter steel pipes, approximately 6 ft. below the ground level, welded at 40- to 50-ft. intervals. The three conductors in the pipe enter through the manholes into bronze bulkhead stuffing boxes where the splice—a trifurcated semi-stop terminal joint of a new design (see page 87) is made. Thence each single-phase lead goes through the bronze end of the joint box to one of three hard-drawn copper tubes (3½ in. i.d., 4 in. o.d.) to risers and terminals. The entire system is maintained under 200-lb. pressure, which is electrically controlled from a pumping plant.

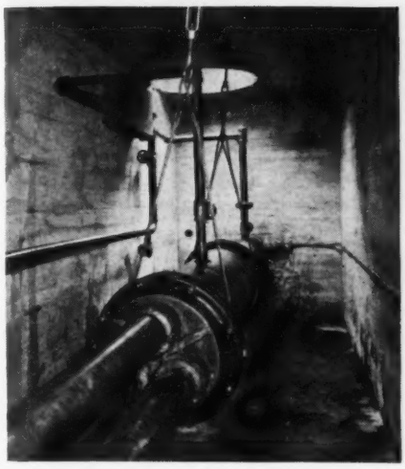
For this particular installation an overhead line would have been difficult to install, since the generating station is close to the property line and the angle of take-off would have required a considerable amount of additional steel structure to clear an existing substation in the older section of the plant and also to provide room for four future circuits from two banks of transformers to be added.

A conventional duct line was eliminated from the discussion because soil conditions were such that part

*Assistant engineer electric engineering department.



CONSTRUCTION HIGHLIGHTS—Cable was pulled in in one leng th (a). Stripped lead sheathing may be seen in left background. The 6-ft. deep trench covering the cable was covered with lime, sand and mortar and then filled with new earth, to avoid electrolysis from acids in cinders. In the manholes the cable was spliced, before entering the risers and terminals, with a trifurcated semi-stop joint of a new design (b). All conductor joints in the system (c) were mechanically made, using a special tubular sleeve compressed radially and shot through with steel pins by a "Temple" gun to develop about double the strength of soldered joints, or about 25,000 lb. pull on test.



MANHOLES are also distinguished by their simplicity

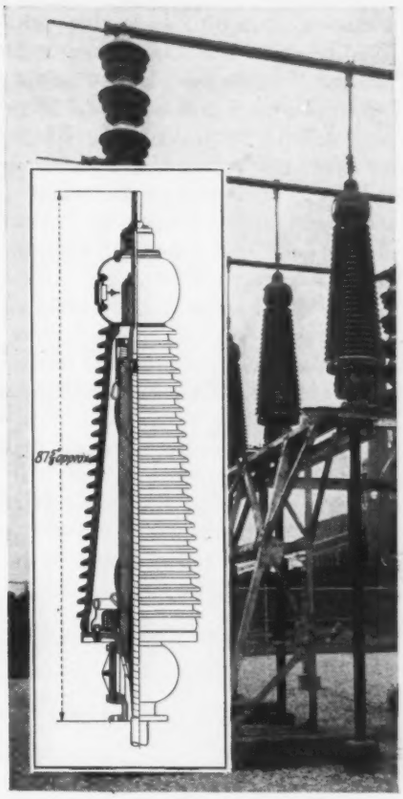
Sling in the foreground supports the joint and also affords a cradle for the shell if inspection of the splice is desired or necessitated. Mounted on the left wall in a cast-iron waterproof box is a by-passing means consisting of an automatic sectionalizing valve, etc. Valves close if the pressure—normally 200 lb.—drops below 175 lb. per sq.in. Bond wire, on right wall, consists of 500,000-circ.mil stranded copper cable. Manholes are 20 ft. long, 5 ft. 3 in. wide and 8 ft. 2 in. deep, to assure adequate working space.

of the line would have had to be supported on piles, whereas it was known that the 8-in. pipe of an Oil-ostatic line had sufficient mechanical strength to be buried in the ground without any supporting piles. In addition, a right-angle bend and two offsets were required, which would have meant three additional manholes and splices. On this job only two splices were needed for each circuit. Also it was evident that the pipe could be installed, welded and cables drawn in in a much shorter time than would have been required for the installation of ducts and cables.

Installation Details

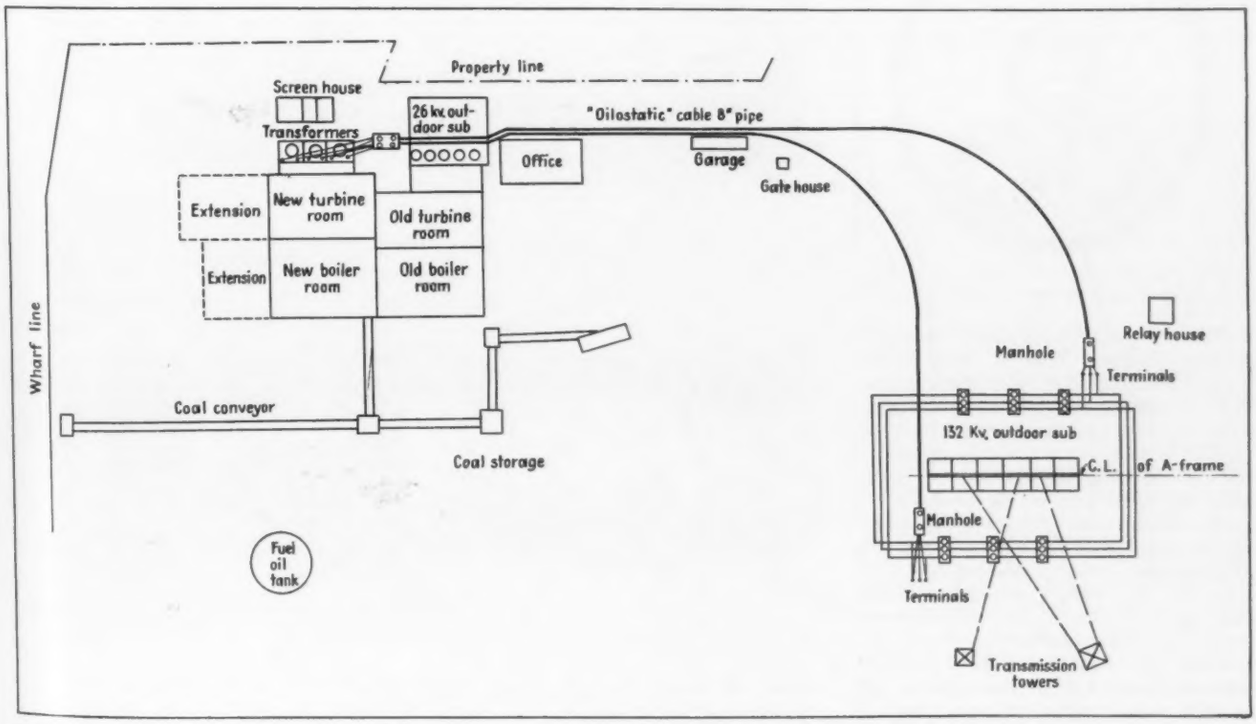
Special technique had been developed to keep the interior of the pipes housing the cable free from moisture during the construction. At the mill the interior was sprayed with a special lacquer, the ends capped with rubber disks and spot-welded steel caps to prevent rusting or damage in transit. Exterior of the pipe was machine-coated at the mill with a priming coat of "Bitumastic" enamel, then wrapped with asbestos felt, again coated with enamel and covered with kraft paper.

After they arrived on the job the pipes were dusted out as an added precaution before the welders made the welds. At the end of each day's work a pressure cap was installed at the last end to seal up the pipe. Dry air pressure was then applied through a special condenser and a small amount of air was allowed to leak out at the far end, preventing con-



SINGLE-PHASE LEADS of cables leave joint box in manholes to enter copper riser pipes leading to terminals (switching station terminals shown)

All-porcelain terminals—shown above in cross-section—are rated 161 kv. and have two distinct oil chambers, with inner or pressure chamber holding oil under high pressure completely to top of cables.



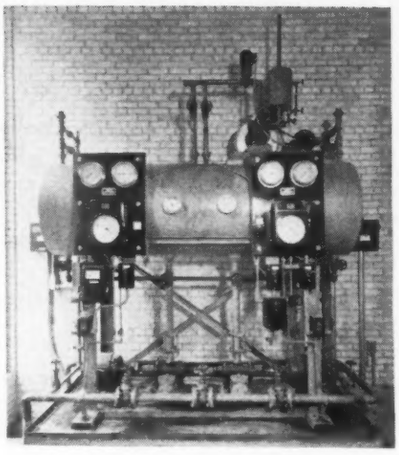
LAYOUT of installation shows space-saving advantages obtained over bulkier overhead system that would have been necessary to clear existing 26-kv. substation

densation in the pipe during the night. This pressure was also sufficient to prevent flooding of the line and to keep out any free water.

Each weld was tested under 100 lb. air pressure, with a brush and soap suds; this method has proved very accurate. After each circuit length of pipe had been welded it was first evacuated, then filled with carbon dioxide gas and sealed up under 6 to 8 lb. pressure. This prevents moisture getting into the pipe line during the interval of pulling-in and splicing of cables.

It may be interesting to know that on this job the pipe line was 6 ft. under water during a flood at Burlington, but when it was tested with a liquid air trap, it was found to be perfectly dry. A further interesting fact is that when the line was filled with oil and a few barrels were drawn off each end, the oil was tested and found to have an average breakdown of 35 kv. for the 1/10-in. gap.

Oil for the pipe line was shipped in a tank car equipped with steam coils. At the job the oil was heated with live steam, passed to a high-pressure pump, through two stone filters in a hydro-volifier and then to a second pump into the pipe line. At the far end of the line a vacuum pump was installed to evacuate the line before the oil was admitted. No circulation of the oil was found to be necessary, since samples at the far end of the line indicated the oil was in excellent condition, as a result of the efficient method of installation.



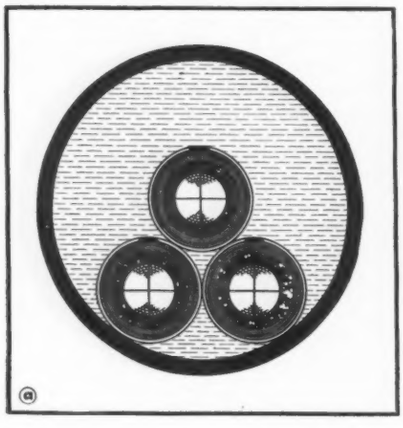
PUMPING PLANT is a dual plant, with the expansion tank divided in half, each section maintaining oil pressure through one cable circuit with its own pump
Cross-connections are provided so that pressure can be maintained with either pump, if necessary. Magnetic indicators—on tank—show level of oil in storage tank. Eight-day recording gauges—on separate panels—indicate the operations of the pumps and act as accurate and automatic detectors of any slight loss of oil occurring in the system.

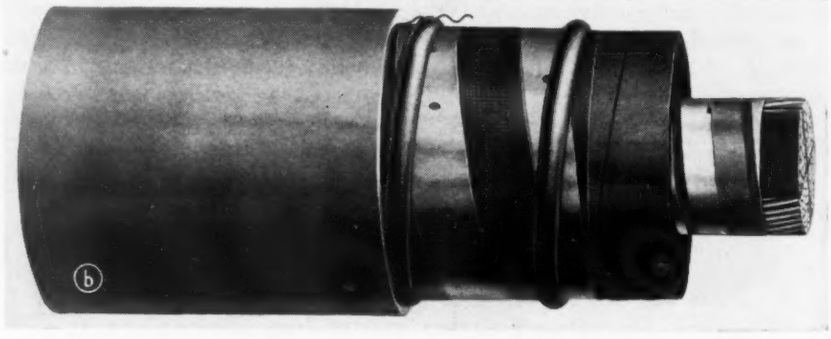
There are two distinct oil chambers in the terminals for the single-phase leads—the inner or pressure chamber maintaining the oil under high pressure completely to the top of the cables. This inner chamber is sealed by spring-loaded joints which automatically compensate for gasket shrinkage. In this manner it is completely isolated from the outer chamber, which is filled with oil at atmospheric pressure.

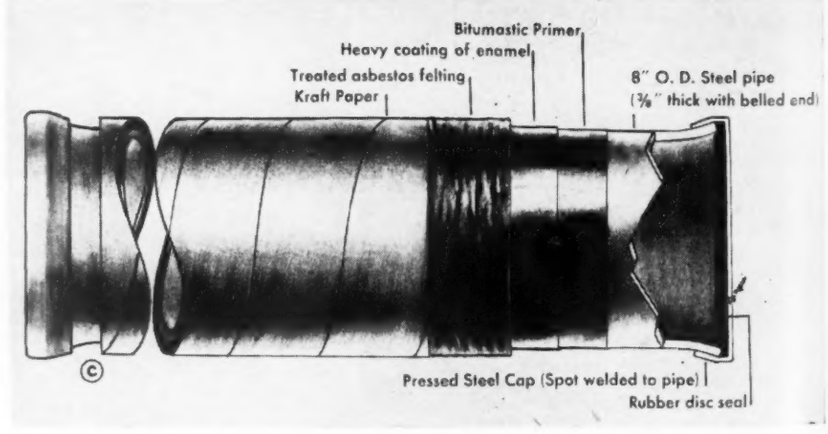
Since a cable is maintained under pressure to the top of the terminal, the reinforcement wrapping with its shielding is under pressure, providing a great increase in dielectric strength of the unit at this vulnerable point. These terminals were completely assembled at the factory and shipped to the field for mounting on top of the riser pipes.

The pumping plant which maintains pressure in the cable system is actually a dual plant. The expan-

[*Continued on page 119*]







Conductors are 1,250,000-circ.mil segmental stranded copper, covered with 560-mil paper insulation, then with 5-mil copper tape shielding intercalated with fabric tape. "D"-shaped armor covers all this (b) and is in turn covered with a temporary lead sheath which has a kinked steel stripping wire underneath for its removal in the field. Diameter over the armor is 2.66 in. "D"-shaped armor does these things: (1) Continuously grounds shielding tape to pipe; (2) short circuits each turn of shielding tape; (3) affords mechanical protection; (4) reduces coefficient of friction (in pulling) from about 0.67 to 0.26. The steel pipe (c) has an 8-in. outside diameter, with a ⅜-in. wall, is bell-ended, and comes in random lengths, *ie.*, 40 to 50 ft. Chill rings are provided for welding so that "icicles" will not form in the interior of the pipe to damage the cables during pulling.

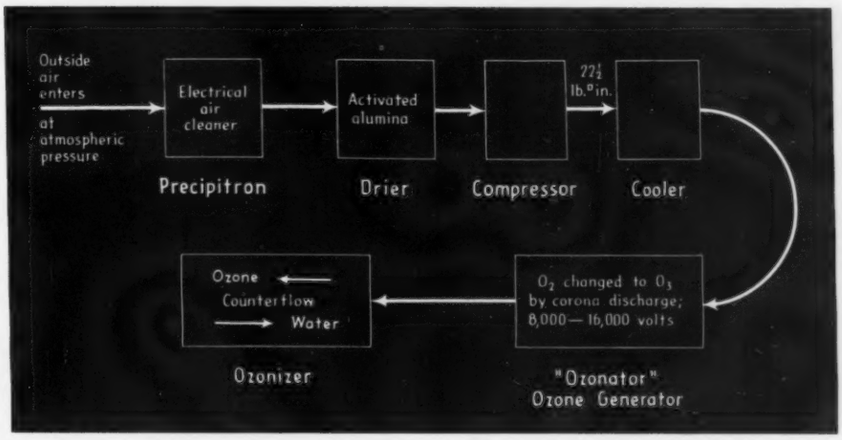
CABLE occupies about 38 per cent of pipe area (a), is rated at 132 kv., 696 amp. at 20 deg. C. earth and 70 deg. C. copper, or 777 amp. at 10 deg. C. earth and 70 deg. C. copper

Electrical Water Purification Builds Added Revenue

Use of ozone to modify employment of chemicals for water treatment opens new field of revenue for the utilities serving municipal water works

J. B. KLUMPP, Consulting Engineer, Philadelphia, Pa.

FIELD operating data and extended tests in the Ozone Processes Company experimental station, Moorestown, N. J., indicate that new ozone processing equipment, designed for adaptation in municipal water works, coupled with lower energy rates, has forced the cost of ozone equipment of central water supplies into new low brackets. It has been found that tastes, odors and discoloration can be removed from many worse than average water conditions with an average "ozone demand" of 10 lb. of ozone per million gallons, and new equipment, especially developed for this purpose, has shown over-all energy consumption of 12 kw.-hr. per pound of ozone generated and applied.



DIAGRAMMATIC SKETCH shows elements of water purification equipment and direction of flow. With an ozone demand of 10 lb. per million gallons of water, usage would be 120 kw.-hr. per million gallons

Auxiliary Uses

The equipment used in this new water treatment process may be classified roughly into five sections, as shown on the diagrammatic sketch, and includes auxiliary uses, which, in turn, involve the use of electrical energy, with the possible exception of the air-drier, in which electric or gas heat is optional, to reactivate the chemical used.

Reference to the diagram shows the steps in the process. The compressor increases the pressure from 1 to 1½ atmospheres, or approximately to 7½ lb. gauge, drawing the air through a chemical adsorbent drier, which may be manual or automatically reactivated by heat application.

Before the air is dried, it passes through an electric "Precipitron," which electrically removes all dust and fine particles. After compression the air is cooled in an after cooler. The fourth step takes place when the compressed, dried, clean and cooled air enters the ozonator, or ozone generator, at which time a predetermined quantity of the atmospheric oxygen is changed into ozone. The final step takes place in the ozonizer, when the ozone and the water meet in a counter-flow action and are thoroughly mixed to establish the intimate contact necessary completely to oxidize and render innocuous the harmful pollutions colloidally suspended or dissolved in the water. The ozonizer is designed to furnish an adequate period of contact between the water and the ozone, this being determined by the rate of flow and the capacity of the ozonizer itself.

Ozone is generated in the ozonator when the compressed air passes through a silent blue corona discharge created between electrodes on the opposite sides of a dielectric plate and which operate at voltages varying from 8,000 to 16,000.

Utilities, therefore, are presented with an ozonation load in the water filtration plant field which offers a 100 per cent load factor over a 24-hour operation and a leading power factor varying from 60 to 75 per cent on the ozone generator to balance any lagging power factor which may be found in the auxiliary equipment and with a total over-all power factor approximating unity to slightly leading. From field tests it has been developed that 12 kw.-hr. is the average energy requirement to produce and apply one pound of ozone. The potential load is, therefore, easy to estimate. For example, where the "ozone demand" shows an average of 10 lb. per million gallons, shall we say, to remove medicinal tastes, odors, or

discoloration, the daily electric usage would be 120 kw.-hr. multiplied by the number of million gallons of water treated daily. A higher "ozone demand" creates a higher electric load, and vice versa. The load, therefore, is contingent on the "ozone demand," and which in every instance should be determined by pilot plant testing in the field. A standard ozone generating unit, with its electrical auxiliaries, nominally rated at 10 lb. of ozone per day, has a 5 kw. maximum demand.

New Developments

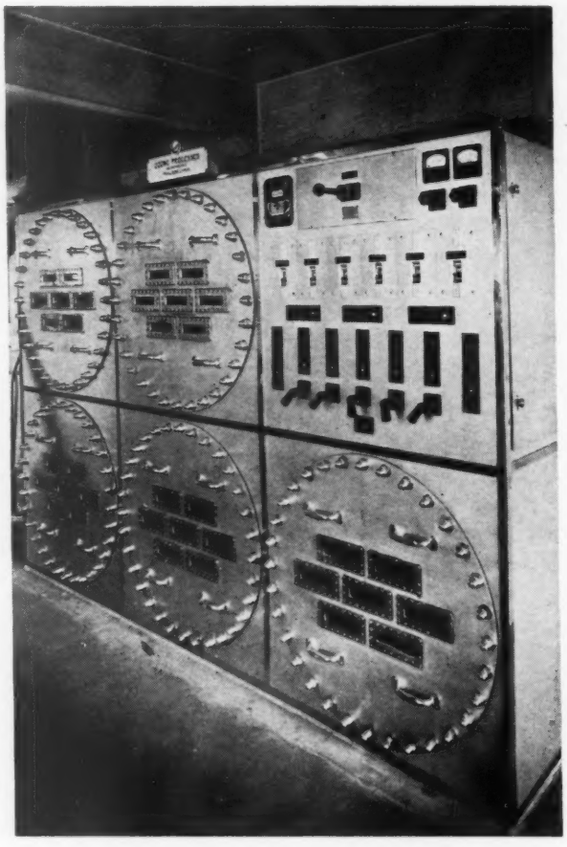
Ozone purification of water has been used in Europe for more than forty years. There are more than one hundred such installations in France alone, and the latest, at St. Maur, Paris, France, to treat 79,000,000 gal. of water a day, was almost completed when the present war broke out.

One of the obstacles facing consulting engineers and water works operators in the United States was the feeling that ozonation was too expensive to be practical. However, when these opinions were developed, higher energy rates prevailed and far less efficient equipment, designed primarily for treating bottled water, was all that could be obtained.

As a result, water works in the United States have depended upon chemical methods, such as coagulation, precipitation and sedimentation, activated carbon, ammonia, potassium permanganate, etc., to remove unpalatable tastes and odors.

Of the many chemical methods used today to make drinking water supplies safe in the United States, the average person is probably most familiar with chlorination. Chlorine is added to the water, and in many instances it is necessary to add it to such an extent that the water becomes unpalatable. Many are familiar with the chlorinous or medicinal taste of water which has been so treated. This is due to the fact that the added chlorine has formed soluble chloride compounds in the water which are distasteful and odorous. Efforts have been made to take care of the criticisms arising from chlorination by introducing ammonia or adsorbent activated carbon, with varying degrees of success.

Ozone, on the other hand, is recognized chemically as a very powerful, if not the most powerful, oxidizing agent known to science. When it is diluted with air and properly controlled, it becomes a most valuable agent in the treatment of water to improve its potability and palatability. It has the unique advantage of being the only available oxidizing agent that does not introduce new chemical compounds into the water. As Morgans, a leading European ozonation authority puts it, "ozone is introduced into the water unadulterated by any chemical in combination with it, and, having completed its mission, it withdraws into the thin air, without leaving the least trace of its passage through the water."



HEAVILY POLLUTED water from the Calumet section of Lake Michigan is treated at the rate of 3,000,000 gal. per day by means of 50 lb. of daily ozone capacity installed at Whiting, Ind., plant

The operating engineer of the utility company probably remembers the extreme instability of ozone as generated in the laboratory of his engineering school. Ozone (O_3) is triatomic nascent oxygen, as compared with natural diatomic oxygen (O_2). It is because ozone is an "unnatural" form of oxygen, continually striving to return to its natural diatomic state, that it is such an efficacious bactericide, attacking all oxidizable organic and inorganic matter immediately on contact. Thus, its molecular instability makes ozone an ideal agent for water purification. This characteristic makes it rapidly attack and oxidize, that is, "cold burn," organic matter in the water and form insoluble, inorganic oxides, which can be removed from the water by sedimentation or filtration.

For Bad Water Problems

The present field for ozone in the water works industry would seem to be where conditions are such that chemical treatments are either too complicated or too expensive to produce a satisfactory, palatable water. Its sponsors are not claiming it as a cure-all or a revolutionary substitute for present methods, but rather as an advancement in the art, applicable to present treatment methods.

It was this advantageous characteristics which led to its being selected for Denver, Pa. Here is a case where the powerful oxidizing properties of ozone are used to treat a polluted surface water supply, supplementing the original palatable spring water supply for Denver, but which is no longer adequate, due to increasing consumption demands. It had been found that chlorination of the supplementary supply imparted a disagreeable taste to the whole supply and was objectionable to the user. Ozonation was chosen to sterilize and remove tastes and odors from the surface supply, without producing any unpalatable characteristics in the finished water.

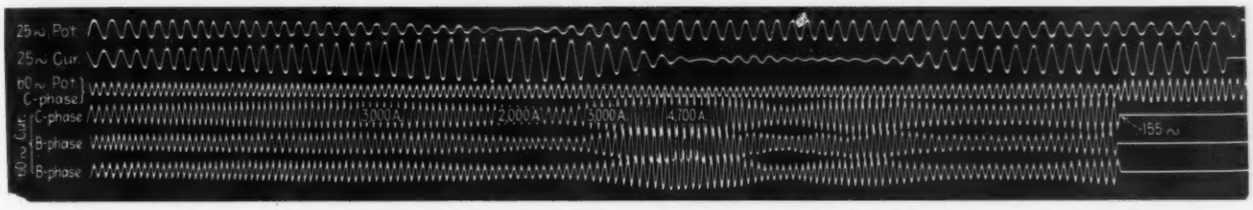
The Denver, Pa., ozone installation has a rated maximum daily capacity of 5 lb. of ozone to treat a plant capacity of 300,000 gal. of water daily.

The ozone equipment went into

[*Continued on page 47*]

Circumstances Attending a Major Metropolitan Disturbance

Outage in Washington attributed to manual tripping of generator being synchronized when generator on interconnection failed and caused simultaneous line disturbance



OSCILLOGRAM shows out-of-step condition on the tie-line after the 230-kv. Washington-Baltimore line opened but while the 110-kv. line was still in service. Taken at Washington end of 132-kv. Baltimore-Washington line where frequency changer for Pennsylvania Railroad is located

INTERRUPTION of a major part of the power supply to Washington, D. C., and Baltimore, Md., resulted from failure of the differential relay on the hydro unit at Safe Harbor to clear the faulty machine. This resulted in tripping the transmission lines from Safe Harbor to Baltimore and Washington. At the time of the trouble the 60-cycle hydro-generators were carrying approximately 160,000 kw. load and this load was dumped on the steam generators at Baltimore and Washington, resulting in low voltage and out-of-step conditions for one minute and 47 seconds, until the 110-kv. line between Benning-Westport cleared. During this period of low voltage the essential fans and pulverizers were lost, in turn causing loss of steam pressure and load.

In Baltimore the load was being carried almost entirely by hydro, with a smaller proportion of steam capacity on the line, and load was restored soon after the transmission lines were energized from Safe Harbor.

A singular coincidence seems to be the best explanation for the extent of the disturbance affecting a major part of the supply to the Washington, D. C., metropolitan area. The coincidence was that insulation in a generator at Safe Harbor failed and relays failed to clear it from the bus at exactly the same time that station operators at the Washington end of the interconnection were in the act of sychronizing a warmed-up machine to carry the load just beginning for the capital day.

The loss of load at Washington has been attributed to the supercaution of the station operators in clearing the oncoming machine from the bus in the belief that the violent voltage swings were due to a defect in this machine. The extended period of low voltage caused electrically driven stokers and other auxiliaries to trip off and thus aggravate the condition.

Prior Conditions

Stoker-fired Benning station (185,000 kw.) is connected through two 33-kv., 20,000-kva. cables directly to the pulverized-fuel Buzzard Point station (120,000 kw.). The Washington system is connected to the Baltimore system by three transmission lines with a total capacity of 135,000 kw. These lines are normally in operation and were all functioning when the disturbance occurred.

Just before the interruption the Washington load was about 110,000 kw., for which Benning was supplying 5,000, Buzzard Point 32,000 and the three Baltimore ties 73,000 kw. Running and on the line ready for the day's load were the following:

Benning No. 10	30,000 kw.
Buzzard Point No. 1	35,000 kw.
Buzzard Point No. 3	50,000 kw.

In addition the No. 2 (35,000-kw.) machine at Buzzard Point was being brought up to speed and the No. 6 (15,000-kw., 25-cycle railway and Edison network supply) generator at Benning was up to speed and had been synchronized at 6:47 a.m. The existing 25-cycle load had been carried by two 15,000-kw. frequency changers.

Immediately the 60-cycle system voltage sagged to about 45 per cent and started to swing. This was accompanied by violent swinging of armature current at both stations. The Benning operator judged that there was trouble in the No. 6 machine, which he had just synchro-

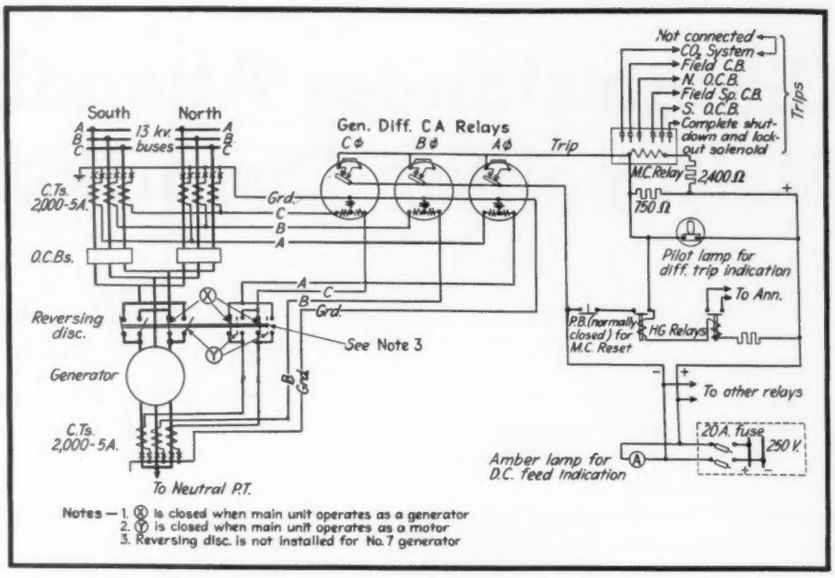
nized, so he immediately tripped it off. That fear proved to be unfounded, the system disturbance really having originated at Safe Harbor. His action and the sustained line disturbance started a chain of consequences which resulted in loss of service which was not wholly cleared up until 8.36 a.m.

Loads Tripped Off

Oscillographic and other records indicate that one of the Baltimore lines (230 kv.) opened in six seconds, another (132 kv.) opened in $2\frac{3}{4}$ seconds by out-of-step relays on the 60-cycle side of the Washington frequency-changer and the 110-kv. line stayed in for one minute 47 seconds, carrying part of Baltimore load, with out-of-step behavior prevailing during all that period.

During this extended period of low and unstable voltage the electric auxiliaries in the two Washington steam stations tripped off. The pulverizing mills and coal feeders at Buzzard Point died and killed the fires. Steam lasted eight minutes to keep No. 3 turbine (50,000 kw.) running. The operating engineer cut off No. 1 unit at Buzzard Point after about three minutes to "save steam for starting again." That left only the 30,000-kw. machine at Benning running to carry a connected load which had already reached 110,000 kw.

To raise the resulting low voltage so as to meet the needs of station auxiliaries the operator began to reduce the excessive generator overloading by opening load circuits. This was not done, however, soon enough to save the auxiliaries and, to make matters worse, the lines between Benning and Buzzard Point were injudiciously opened, leaving the latter without voltage.



AUXILIARY d.c. relay failed to actuate tripping of generator differential relays because it had been shorted out by defective control wiring

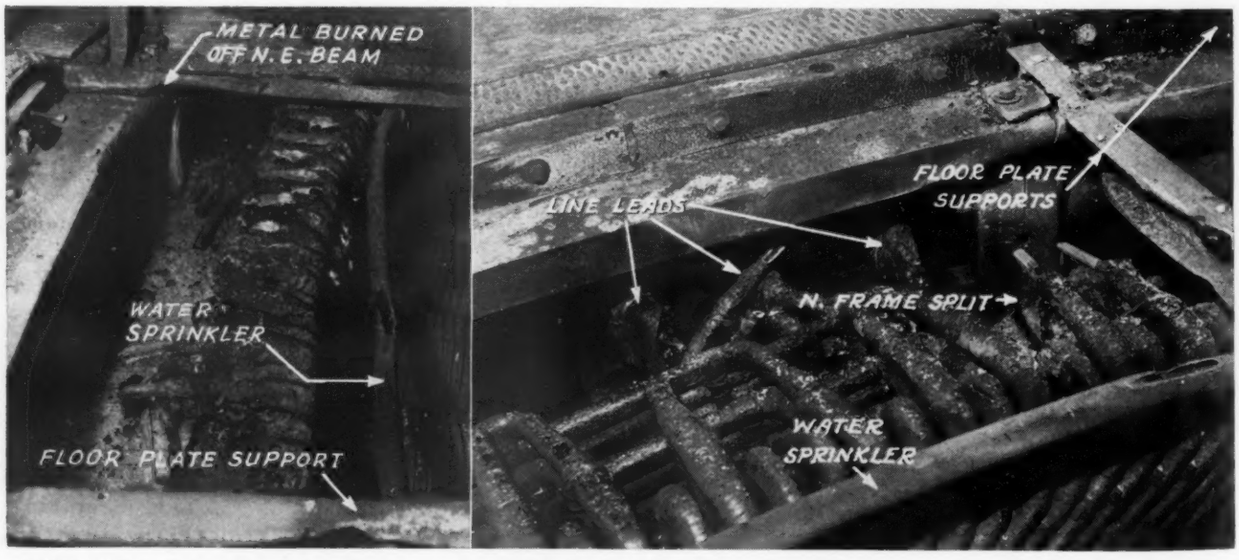
Mistaken Judgment

For some time after the initial manifestations of trouble the operating personnel could not put its finger on the source of the disturbance and confusion was a natural sequel. Of course if the relays at Safe Harbor had cleared the faulty machine as they were designed to do, the Washington system would have suffered a momentary voltage fluctuation of probably less than a second's duration.

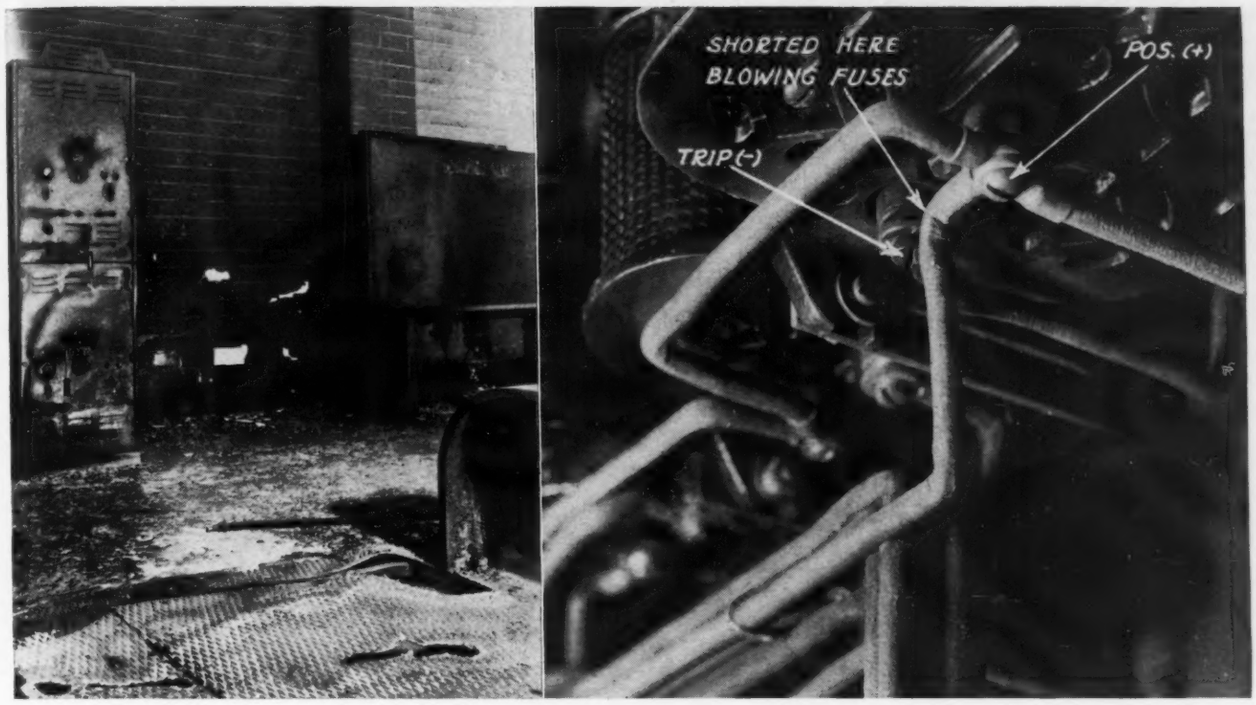
Study by the officials of the Potomac Electric Power Company has not indicated the need for major alterations of system arrangements. The conclusion reached has been that certain operators acted in hasty manner to trip machines, opened lines injudiciously and unnecessarily delayed the restoration of service after power was available.

Differential Relays

At Safe Harbor the No. 5 generator (30,000 kw.) suffered an electrical breakdown at about 6.46 a.m. on December 21, 1940. The generator is protected by differential relays (see diagram). The CA differential relays functioned, but the d.c. (MC) auxili-



APPEARANCE of the Safe Harbor generator after the shell was removed to start repairs



FLOOR AREA DAMAGE caused by stator winding short circuit (left). Generator differential relay trip-circuit loading resistor (750 ohm). Short circuit on wiring caused by generator stator winding short-circuit (right)

ary relay failed to close and trip the O.C.Bs. because it was shorted-out by a fault in the insulation of the control board wiring.

While no final conclusion has been reached as yet regarding the cause of this shorted-out path, the evidence so far developed seems to indicate that the above mentioned fault probably existed before the generator failure had taken place, having developed subsequently to a satisfactory periodic test of the relay sequence made in October. There is, however, still a possibility that high voltage during the generator short may have entered the control wiring and contributed to the above fault in the wiring. This possibility is still under investigation.

The fault continued for about 55 seconds (*i.e.*, 6:46–55) and was cleared when the control board operator tripped the generator circuit breakers. At 6:47–57 the 220-kv. line to Westport station (Baltimore) and Washington was energized. Washington closed in on this line at 6:55.

The breakdown occurred in the end turns or in the connections to main or neutral generator leads adjacent to the point where the main power leads leave the machine. Many end connections were completely melted and it is not possible to establish precisely the origin of the breakdown. About 160 stator coils are being replaced. The end connections of these new coils will be provided with increased spacing, improved bracing and mica insulation. The end connections of the undamaged portion will be similarly modernized. It is estimated that the machine can be returned to service within three months from the date of failure.

First Mishap

After many years of perfect record this was the first major equipment mishap at Safe Harbor. Every one of the eight men present in the station at the time did his work as he had been instructed to do and without a single false move or lost motion. Except for the failure of the auxiliary to the differential relays all other automatic protective devices and equipment functioned as they were installed to do. The fire was extinguished promptly because the men acted in accordance with the prescribed rules and with the training given them. Safe Harbor plant was operating under wide open output within eleven minutes after things started to go wrong.

Electrical Water Purification Builds Revenue

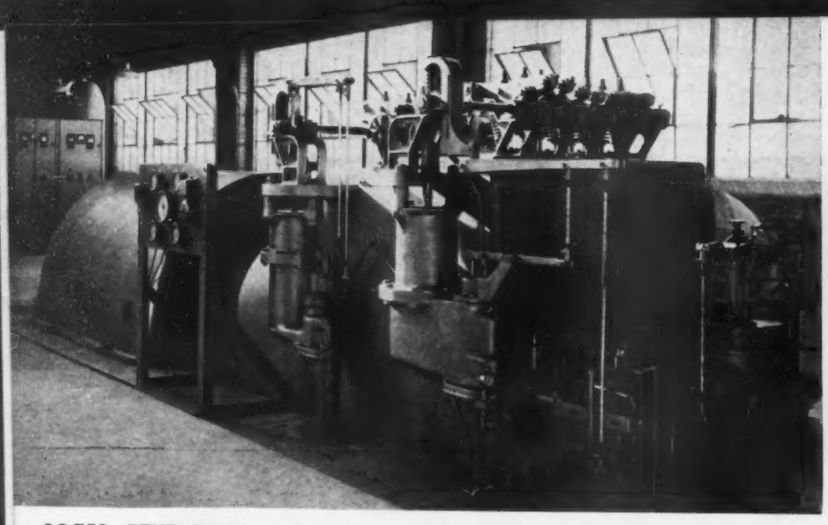
[*Continued from page 44*]

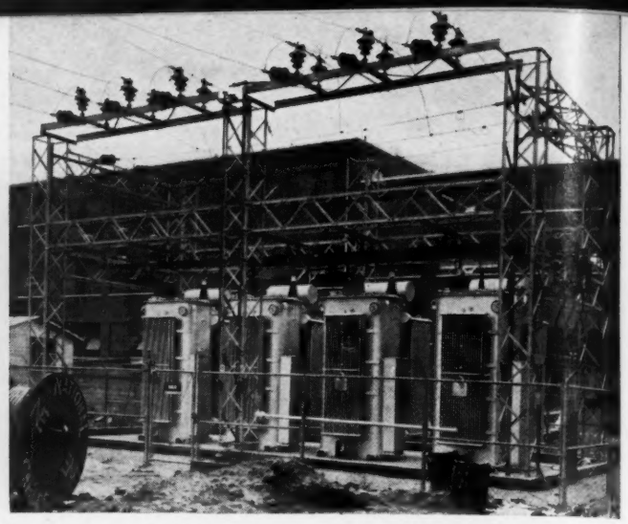
operation in March of this year, and, while it is too early to furnish conclusive operating data, it can be stated that a sparkling, limpid. taste- and odor-free water is being produced, very much to the liking of the Denver users.

Another new installation, being completed at the time of writing, is at Whiting, Ind., where a total daily ozone capacity of 50 lb. is being provided to treat 3,000,000 gal. daily. The source of Whiting's water is from an intake in Lake Michigan, which, due to industrial developments in the Calumet region, is heavily polluted with sewage and industrial wastes. After extended ozone pilot plant tests, it was found that ozonation made this water palatable by removing the obnoxious tastes and odors due to pollution to a degree economically impossible with present chemical treatment methods.

This is the second ozonation plant on the lines of the Northern Indiana Public Service Company, the other being at Long Beach, Ind., installed in 1930.

A similar installation was made in 1932 at Hobart, Ind., by the Hobart Light & Water Company.





LOCAL GENERATION and utility service paralleled for mill energy supply. General Electric, 7,500-kw. non-condensing turbo-generator is bled for process steam and additional power requirement comes from utility system through this substation

Electrical Modernity in a Paper Mill

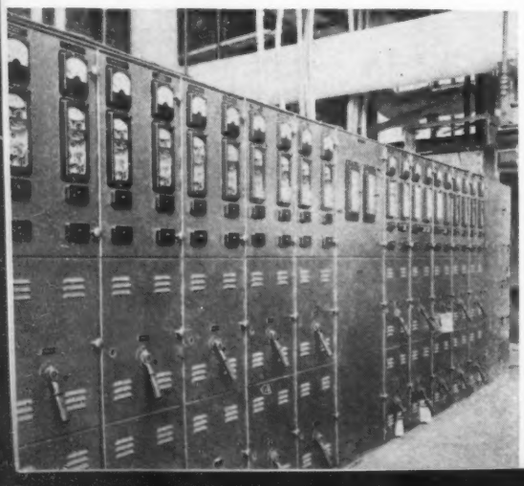
Latest ideas in electrical distribution and control design make for ease of operation, safety to workers, reliability of energy supply

A. C. BIRD, Electrical Engineer, H. S. Ferguson & Company, New York

PARALLEL operation of local generation with utility energy supply, unit controls assembled in load centers, short-circuit protection at the load as well as at the supply bus, use of lead-covered cables for distribution feeders and carrier-current control for pump motors at distant wells are features of the electrical installation in the new Kraft pulp and paper mill of the Hollingsworth & Whitney Company at Mobile, Ala.

The mill is designed to produce 190 tons of slushed sulphate pulp daily, of which 100 tons can be bleached. The pulp may be converted into bleached or unbleached kraft paper or board, or a part can be shipped in dried bale form. Three drying machines are contained in the mill. One is a Foudrinier machine with 184-in. wire designed for drying at speeds from 200 to 1,200 ft. per minute, depending on unit weight of product. This machine has a sectional electric d.c. drive with Ward-Leonard control and regenerative braking for the sheet winder. The second is a 124-in. cylinder machine with a speed range of 50 to 200 ft. per minute, used for heavy papers or board. The drive is d.c., line-shaft type with helper motors. The third machine is a Fourdrinier with 90-in. wire with line-shaft drive coupled to a variable-speed, wound-rotor induction motor.

FEEDER CUBICLES for 480-volt distribution in turbine room



Electric power is generated at the mill, to the extent of the steam available for process requirements, by a 7,500-kva. General Electric steam turbo-generator designed for a normal pressure of 550 lb. per square inch gauge and bleeding at 130 lb. and 30 lb. for process steam. Steam is generated in gas and bark fired boilers at a pressure of 600 lb. p.s.i. gauge and total temperature of 725 deg. F.

The electrical load exceeds the amount of power which can be derived from process steam under average conditions, and it was found desirable to purchase the additional power from an outside source rather than generate it with a condensing turbine.

Mill generator operates in parallel with a public utility power system on the mill bus, and protective equipment has been provided to prevent overloading of the mill generator in the event of incoming power interruption. This is accomplished by installing relay equipment of the reverse current and frequency type, which automatically cuts out certain non-essential loads, disconnects the incoming power source and places

the turbine on speed control during the emergency period.

Main switchgear controlling the 2,400-volt generator and feeders is located in the generating station and consists of electrically operated oil circuit breakers, disconnecting switches and auxiliary devices mounted in totally inclosed steel cubicles.

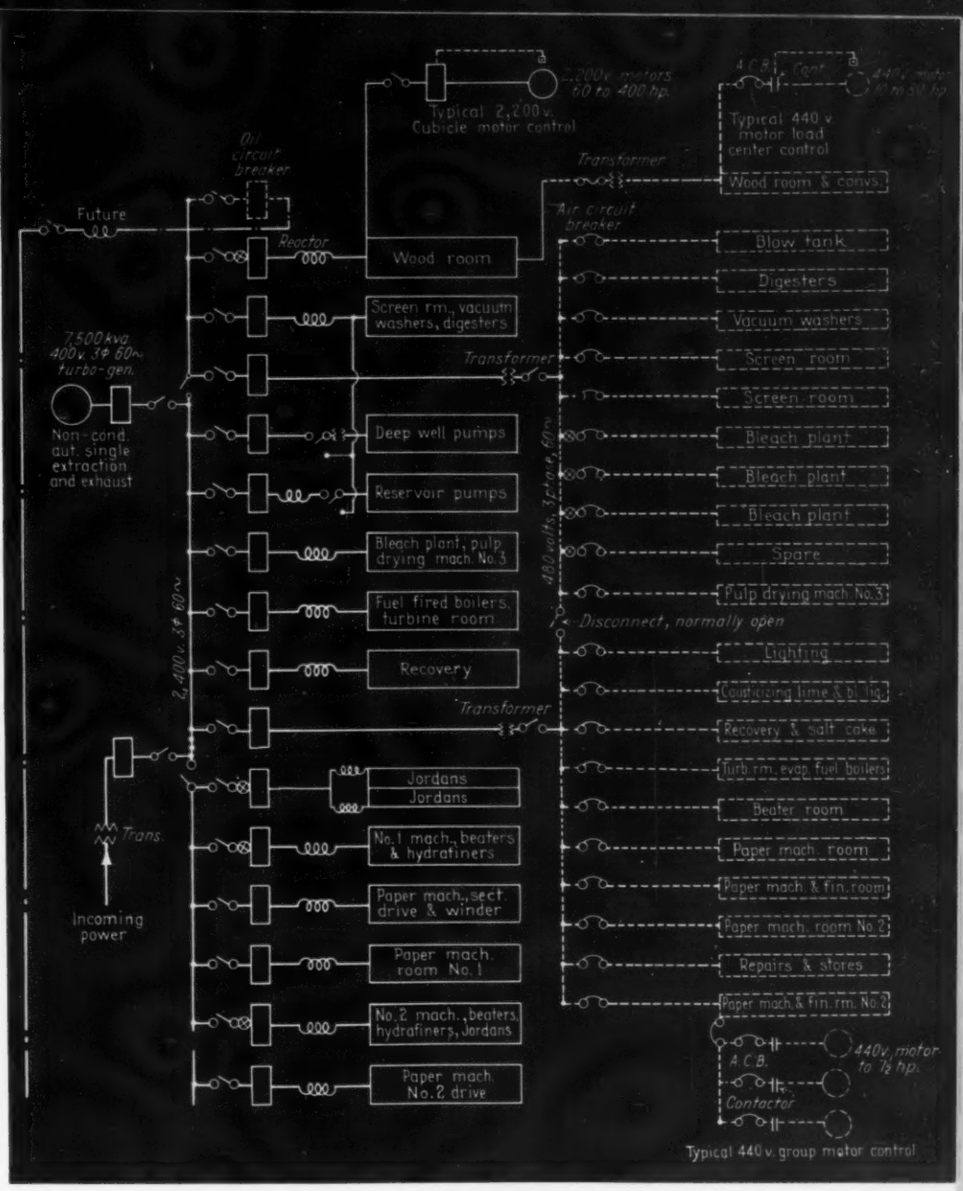
The 480-volt feeder distribution switchgear is also located in the generating station and consists of manually operated air circuit breakers and auxiliary equipment completely housed in steel cubicles.

Motor Control

Power is generated at 2,400 volts, three phase, 60 cycles and delivered to various load centers throughout the mill to supply motors 60 hp. and over. These load centers consist of individual steel cubicles containing electrically operated oil circuit breakers, disconnects, protective and metering equipment, bussed together to form a load center from which motors can be started at full voltage by push-button control.

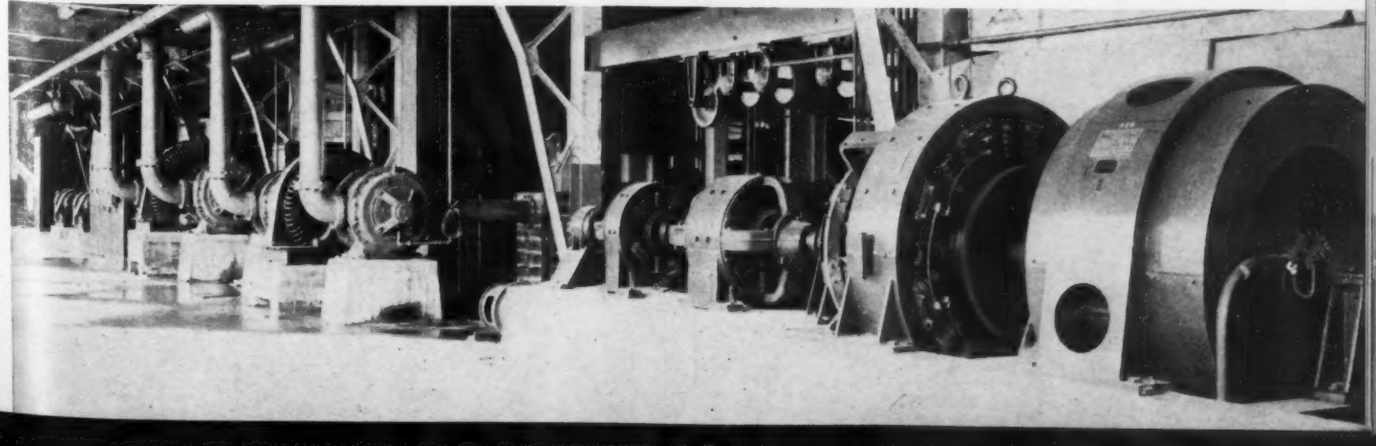
Motors up to 50 hp. are operated at 440 volts by power supplied from 2,400/480-volt transformer banks and delivered to the various load centers in the mill where the motor control is located. These load centers consist of steel-inclosing cabinets of the self-supporting, dead-front type, completely wired and bussed, and containing six or eight cubicles for the individual motor control. The motor control consists of an air circuit breaker for short-circuit protection and contactor type of starter with thermal overload protection operated by a push-button station, which may be located at the load center or at the motor. The cubicle compartments have been made of uniform size so that by disconnecting the motor and control leads and thumb screws in the rear of the case the entire cubicle can be withdrawn from the load center by disengaging bayonet type contacts from the bus. There are only two sizes of control and units in each size are interchangeable. This facilitates maintenance and replacement.

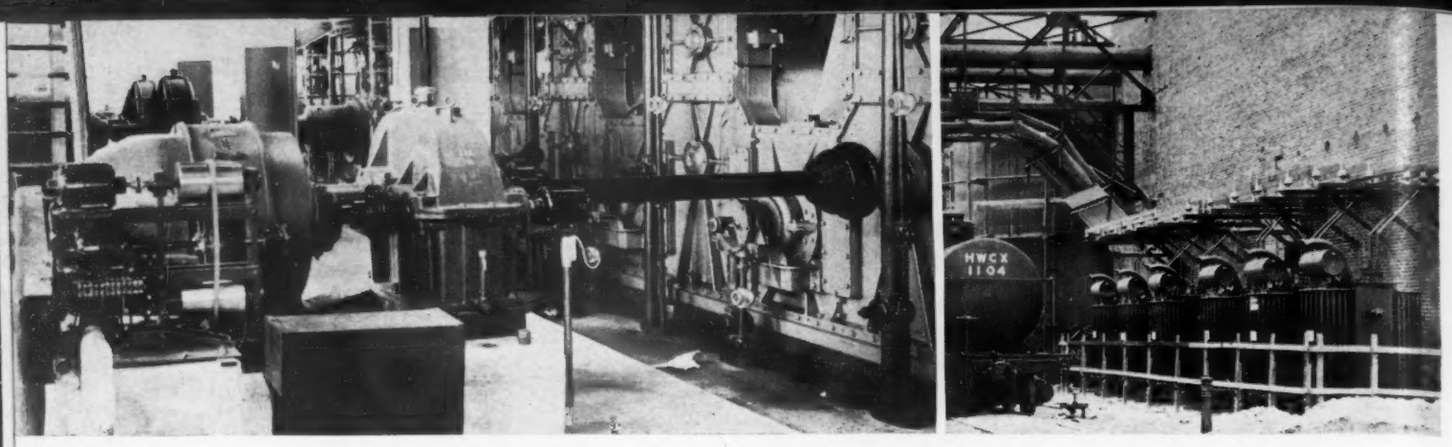
This type of control has the advantages of factory-built equipment completely fabricated and ready to connect motor, control and feeder leads and eliminates entirely the necessity for field construction of feeder boxes, connections and supports. These load centers can also be located in suitable places in the mill away from moisture and are only accessible to skilled mechanics for repair or maintenance. Spare positions in some of the control centers allow for expansion.



SCHEME of distribution. Note reactors at 2,400-volt loads, to limit short-circuit currents to breakin capacities of motor control equipments

MOTOR GENERATOR SET for d.c. drive of No. 1 paper machine. Motor-driven vacuum pumps in rear





ECTIONAL DRIVE for dry end of No. 1 paper machine (left). At right two 2,500-kva. transformer banks for stepdown to 480-volt upply. Pipe bridge carries power cables in racks below

A complete study was made of the short-circuit currents which might occur at the various sections of the mill and protective equipment was installed which would completely isolate the fault at the source, so that interruption of service would be confined as far as possible to the equipment involved.

The short-circuit current, which must be interrupted by the feeder breakers on the 2,400-volt bus, was estimated at about 125,000 kva. and oil circuit breakers were installed to meet these conditions. This large amount of power, reduced slightly by line impedance, contact resistance, etc., must also be interrupted by the 2,400-volt motor-control equipment if the fault is to be isolated at the source.

Since it would be uneconomical to install motor-control equipment to interrupt such large currents, reactors are inserted in the 2,400-volt mill feeders to limit definitely the flow of power to 25,000 kva. and the control equipment was designed on this basis.

For economic reasons some mills have been equipped with standard type control having a low short-circuit interrupting capacity which depends upon the main feeder breaker to open under short-circuit conditions. Experience has shown that this type of control will often be completely destroyed due to the heavy inrush currents existing during faults, causing complete feeder outage, injury to attendants and lengthy loss of production.

The author firmly believes that protective equipment should be installed to isolate the fault at the source and the extra cost to do this is justified.

Deep-Well Pumps Control

The mill fresh water supply is obtained from 24 wells, most of which are located a few miles from the mill site. Individual pumps are located at each well, which deliver the water to two reservoirs near the mill.

Power for driving the well pump motors is stepped up from 2,400 to 13,200 volts for transmission and is delivered to the well motors at 480 volts through step-down transformers at each well site.

A unique method was devised so that the operator at the mill, by watching the reservoir water level recorders, could control these pumps from the mill and also adjust the well pump load to limit peak loads during certain periods of operation.

The well pump motors can be operated either at the well site for local control or at the mill generating station. Remote control of the motors was accomplished by the use of carrier-current transmission which superimposes a current of 720 cycles on the 13,200-volt transmission line. If the operator at the mill wishes to "start" or "stop" any individual well motor he presses a button which starts the carrier-current generating system operating, initiating an impulse code cycle operated by a multi-finger timing relay. At the same time multi-finger timing relays are set in operation at each well site, which automatically start or stop the specified motor when the proper push button is operated, as governed by the coded control.

Wires and Cables

Varnished cambric lead-covered armored cables, racked on transite supporting plates, were used for the main power feeders from the power house to the mill load centers. This type of cable offers the advantage of maximum current carrying capacity per circular mil, with lower installed costs for the sizes used, as compared with other types of cable in conduit with equivalent current-carrying

[*Continued on page 117*]

MOTOR LOAD centers. Cubicles at left are for 480-volt controls and at right for 2,400-volt motors

ISOLATED well pump house and power supply. Control is by carrier current

Flashboards Release Flood Like "House of Cards"

Tripping at one end releases successive swinging sections across half of dam — Breakaway flashing superposed on swing units

JULIAN WALTON, Belton Light & Power Co., Belton, S. C.

FIG. 1—FLASHBOARDS pivot about reinforced pipe columns
The columns are 8⅝ in. (outside diameter) pipe concreted about 100-lb. rails 8 ft. long set 4 ft. into the top of the dam. The successive sections of flashing overlap about 3 in. Each section releases the next in order as it swings downstream when the end one is released. The diagonal cleats are 4 x 12-in. timbers.

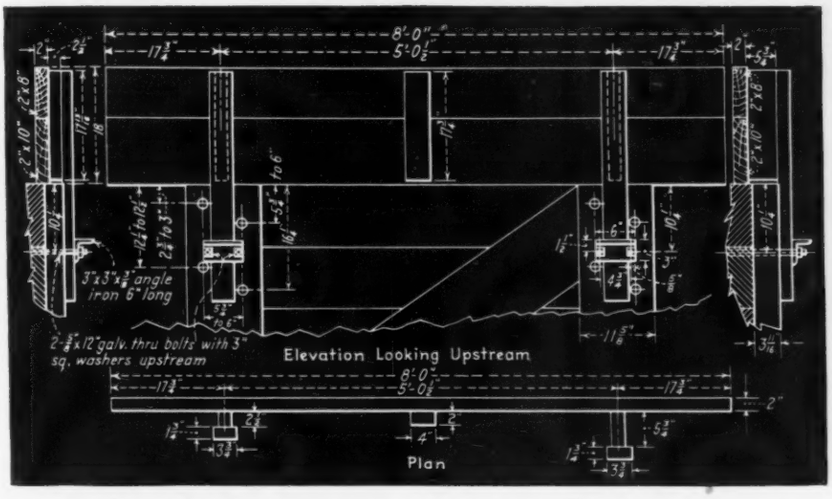


FIG. 2—TOP FLASHING 18 in. high released by breaking of two "two-by-fours" in sockets on swinging flashing

FLASHBOARDS for the dam at the Belton 5,246-hp. hydro plant have been arranged to swing downstream one after another as the end unit is released at time of flood. Each section overlaps the adjoining one in such manner that the tripping progresses in cascade manner like a "house of cards" as soon as the preceding one has swung through a certain angle. Atop this structure (as shown in Fig. 2) there has been placed a breakaway flashing 18 in. high designed to yield whenever the pond should rise an additional predetermined amount before the main flashing could be released.

The dam is 385 ft. long and there are 48 sections of flashing (8 ft. long with columns at 8-ft. spacing) arranged to pivot about reinforced columns set into the dam. Each section of flashing consists of five pieces of Taylor-Colquitt creosoted pine timber dressed to 9⅝ x 3⅝ in. cross-section. At the overlap they are reinforced for the whole height by steel facing or angle-iron to insure a positive and durable release action. Detailed dimensions of the design are given in Figs. 2 and 3. End sections are released by pulling a ¼-in. stainless steel

[*Continued on page 124*]

Ultimate Breaking Strength of "2x4" Southern Pine Stakes

Sized to	1⅝ x 3⅝ in.		1¾ to 3¾ in.		1 13/16 x 3 13/16 in.	
	Lb.-In. Resisting Moment	Ft. Water Over 18 In. Board	Lb.-In. Resisting Moment	Ft. Water Over 18 In. Board	Lb.-In. Resisting Moment	Ft. Water Over 18 In. Board
Min. (75% strength)	10,800	1.01	12,900	1.32	14,100	1.50
Aver. (100% strength)	14,400	1.54	17,200	1.95	18,800	2.18
Max. (125% strength)	18,000	2.07	21,500	2.60	23,500	2.90

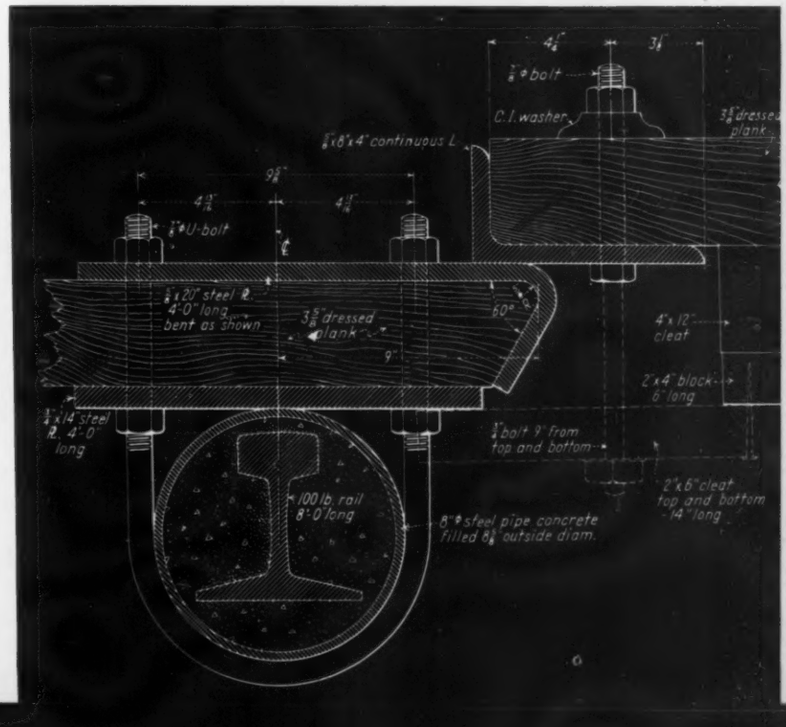
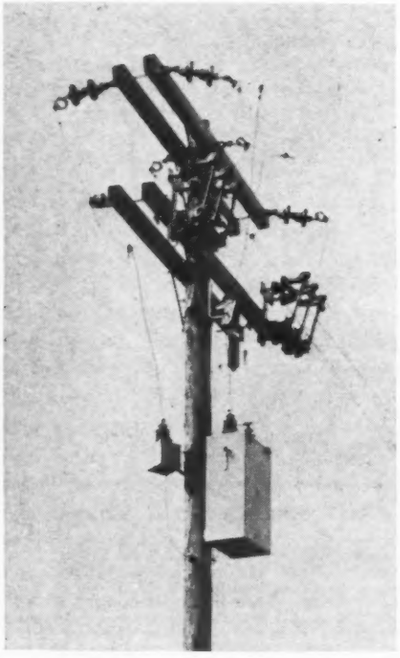


FIG. 3—Reinforcement at overlap joint consists of angle iron and formed steel

Carrier Indicator Reports Rural Outages

Prompt knowledge afforded of interruption at sectionalizing point expedites service restoration to co-operatives*

DONNAN E. BASLER† and JOHN F. ATKINSON,† Rural Electrification Administration



TRANSMITTER of outage indicator at sectionalizing point for two-phase wires and grounded neutral. Small auxiliary pilot capacitor at left converts single-phase unit for multi-phase operation

AS THE RESULT of approximately two years of research and design REA, through its co-operatives, is about to begin extensive field tests on a new carrier-current device. This device has been designed for use on the rural distribution system to provide immediate indication of the outage of sectionalizing equipment. Thus it will be possible for these distribution co-operatives to improve further the continuity of service to their member-consumers.

The interest that REA has had in this development came as the result of several conditions that exist on the rural distribution systems in connection with system operation. In many areas of rural America there is insufficient telephone communication to provide adequate knowledge of interruptions to service. In those areas there was no question as to the need for such an indicating device.

Even in the areas where telephones were available there were reasons for desiring an automatic indication of service interruptions. With the use of telephone services the expense of reversed charges on toll calls resulted in a sizeable item in the monthly operating expense. An automatic indicating device would provide for more prompt receipt of the knowledge of a service interruption. This would make possible an increase in operating revenue due to the reduction in interruption time.

More important is the improvement in consumer good will which the improvement in service would insure. These considerations definitely established the value of such an indicating device to the rural distribution system provided that simple, low-cost equipment could be designed.

Cooperative Surveyed

In preparation for the design of the carrier-current equipment a survey was conducted by REA engineers on the system of the Clay Electric Co-operative, Keystone Heights, Fla. The test equipment was designed to provide necessary data from which it would be possible to determine the practicability of using carrier-currents on the REA type multi-grounded distribution lines. This information included data on desirable carrier frequencies, power requirements, line impedance, line attenuation, line noises and methods of coupling. It was found that with a nominal power output, in the order of 25 watts, and with a frequency of 80 kilocycles, it was possible to transmit carrier energy satisfactorily over distances up to 60 miles. Since this would fully meet the re-

RECEIVER is located at some point along the line near to the office

* Patents pending.

† Assistant research engineers, Technical Standards Division, REA, U. S. Department of Agriculture.

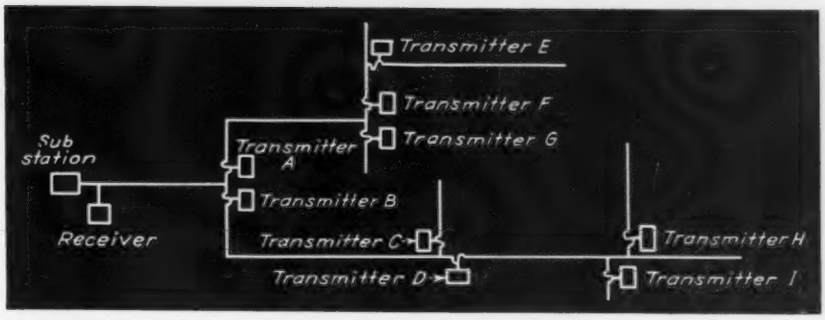
quirements normally to be encountered on the average distribution system, it was decided that the design should be carried forward.

Based upon the data obtained in these tests, REA engineers designed the indicator system to be described. This system provides for the installation of a carrier-current transmitter at each sectionalizing point in the distribution system at which such protection is desired. Each transmitter is to be identified by a characteristic code which it will automatically transmit when in operation. The receiving equipment is to be located at the system office, maintenance center or other central point in the system. Connected to its output circuit will be a tape recorder which will make a permanent record of the received signal, time and date that it is received. Thus all necessary information is available for locating the faulty section and maintaining the operating log.

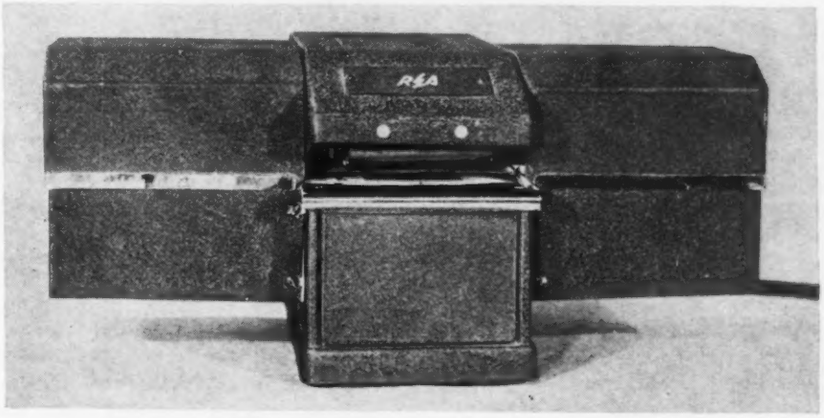
The original development and survey were carried on by the authors for REA. The final commercial development is being carried on by the Stewart-Warner Corporation.

Transmitter

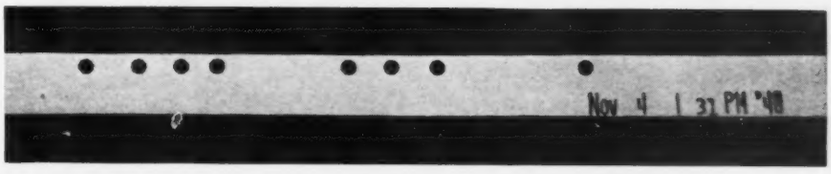
The transmitter unit consists of the following equipment mounted in a metal weatherproof case: A 7,200/120-volt transformer of 150 watt capacity, the carrier-current transmitter with associated keying and re-



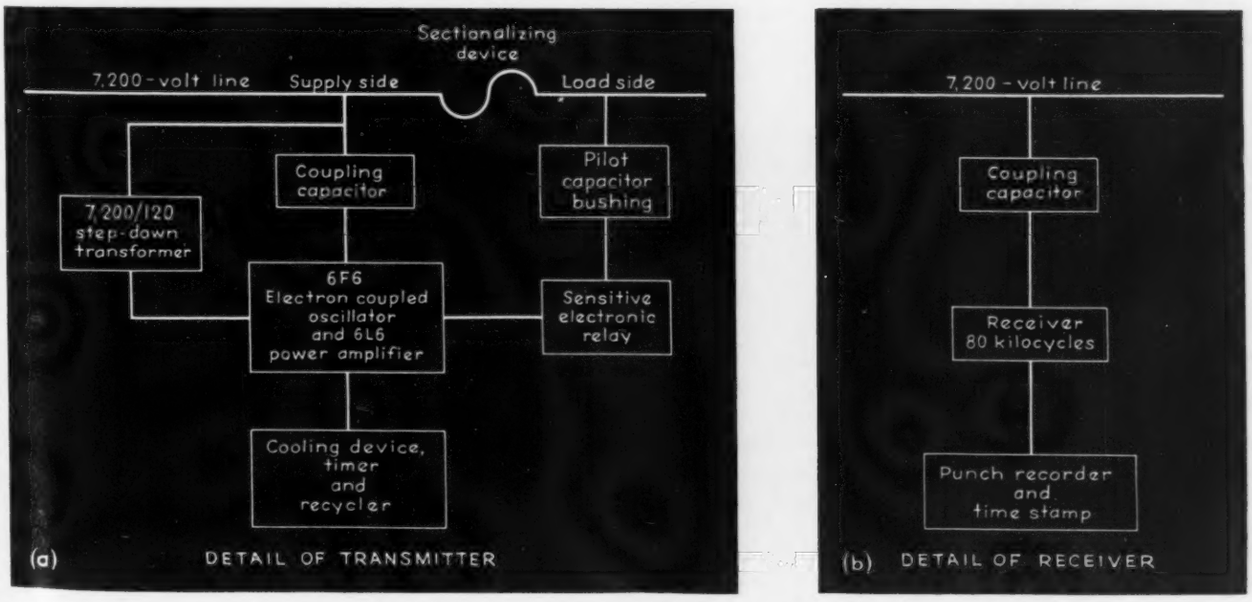
TRANSMITTERS located at all important sectionalizing points



PUNCH RECORDER and time stamp unit



CODE SIGNAL and time on tape indicate time and place of outage



BLOCK DIAGRAM of outage indicator system. (a) Transmitter bridges the sectionalizing point to report failure on delivery side. (b) Receiver, actuated by carrier, in turn actuates punch recorder and time stamp at headquarters

lay equipment, a 7,200-volt coupling capacitor to couple the transmitter to the phase wire and a 7,200-volt pilot capacitor to be used in connection with an electronic relay which controls the operation of the device. The carrier circuit is phase to neutral, thus making necessary the use of only one coupling capacitor and also making possible the standardization of the unit for use in all situations. The unit is arranged for pole mounting and is entirely automatic in operation. It is believed at the present time that no adjustments will be necessary when the unit is installed, since the previous tests indicated that the coupling to the line is not critical. Provisions are included in the design for operating the transmitter through its complete cycle when performance tests are desired. The operating cycle of the unit is as follows:

1. Upon opening of the sectionalizing fused cutout or breaker the transmitter operates for a period of three minutes, sending the coded signal to the receiving point. It then automatically shuts down in order that subsequent signals from other sectionalizing points can be received without interference.

2. Upon restoration of service to the faulted section of line the transmitter again operates, sending the same code for two minutes as an indication that the service is restored. It also recycles to its initial condition and ceases to operate until the next fault occurs.

When used on lines with two or three phase wires and neutral, the transmitter unit remains unchanged. The necessary connections of the relay circuit to the other phases are made through externally mounted pilot capacitors as shown in the accompanying illustration. This is a photograph of a test and not a permanent installation.

Receiver

The receiver will be inclosed in a metal weatherproof case arranged also for pole mounting. It requires an external source of power at 120 volts, 60 cycles and will be connected to the phase wires through coupling capacitors similar to those used with the transmitters. The receiver incorporates permeability-tuned circuits with diode detection and a gas tetrode in the output stage for relay

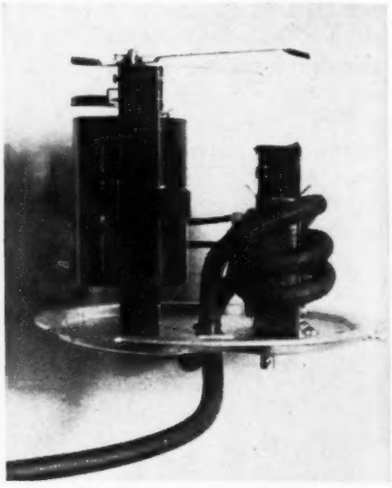
[*Continued on page 120*]

Thermal Meters Guard Station Transformers

Low-cost measurement of transformer loading in small distribution substations obtained by thermal ammeters in neutral leads

R. C. SLACK, Atlantic City Electric Company*

LOADING LIMITATION of electrical equipment such as transformers is usually governed by the maximum temperature conditions. Engineers and operators now feel, based on several years' experience, that the thermal meter gives a good indication of equipment loading and fills a long-standing need for an economical method of following the loading of power transformers. The principle of the thermal meter is well known in the field. It is only necessary to state here that unlike the standard ammeter it does not give the instantaneous value of the current measured, but, as the name suggests, the thermal meter follows a logarithmic curve with time, similar to the heating curve of electrical insulation and equipment.



THERMAL AMMETER embraces self-contained current transformer for insertion in neutral leads. Turn-ratio change readily extends full-scale rating of 60 amp. to 90 or 180 amp.

Thermal Ammeters

During the past several years it has been the practice of the company with which the author is connected to install thermal indicating ammeters on substation transformers. These instruments were used with two or three current transformers and were installed on switchboards if convenient and if space was available or in outdoor meter inclosures.

There are a number of small substations on our system where only fuse protection is installed and current transformers are not needed for relaying and metering purposes. The cost of installing current transformers (either of the outdoor or indoor type, inclosed in a conventional cabinet) to obtain the desired thermal ammeter records would be approximately $200. While not a prohibitive figure for a single installation, if the required applications are numerous the total investment in such equipment may become quite large. An additional factor is that space is oftentimes at a premium on some of the station structures for mounting current transformers.

Thermals in Neutral

A study of this problem was made with a view toward securing the loading information desired at less cost. Most of our stations are 4-kv. distribution and consequently lend themselves to metering in the neutral side,

* General meter superintendent.

between transformer and ground. This practice has been used to advantage in the past on certain applications, especially where high-voltage equipment is involved. Since the potential between the neutral side of the transformer winding and the ground connection is small, our first attempt at a solution was to install a low-voltage current transformer in each leg. However, the saving is not great (approximately 15 per cent) over the 5-kv. insulated transformer and the problem of suitable mounting space still is present. We then decided that perhaps a more economical, as well as a more compact, installation would be to use a properly designed outdoor type of thermal ammeter of a self-contained 50 or 60 amp. rating which on 4-kv. installations would take care of loadings of from 350 to 420 kva. Ammeters installed in this manner would, of course, have line current passing through them.

Meter Specially Built

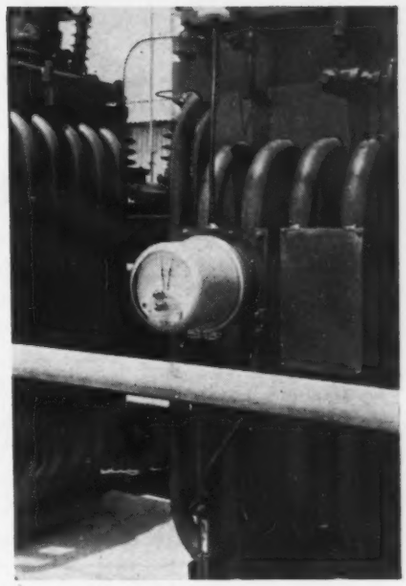
A manufacturer of thermal meters was requested to make up such a meter for trial. It consists essentially of a small self-contained current transformer and a thermal ammeter movement in an outdoor meter mounting. The primary of the transformer has three turns of No. 2 AWG extra flexible, well-insulated wire extending through two bushings in the back of the base with approximately 5 ft. of wire on each side, for direct connection to the transformer bushing and ground bus, respectively. It is imperative that the neutral side of the bank be closed at all times; therefore, the fewer connections made and the more difficult the meter is to remove; the safer the installation.

Multipliers Easy

The secondary of the current transformer provides the current for operation of the thermal demand element and is so designed that the instrument has a full scale rating of 60 amp. Since the primary winding consists of three turns and is removable, the capacity of this device can readily be made either 90 or 180 amp. by simply changing the number of turns from three to two or one turn, respectively; the limitation, of course, being the safe carrying capacity of the wire under the stress of fault currents which could amount to 20 to 30 times normal rating. Scale multipliers of 1.5 and 3 could then be applied to the 60-amp. scale or a new direct reading scale can be provided at a nominal cost. This does, therefore, give us a compact, simple device for obtaining the loads on power transformers up to 1,250 kva. capacity in 4-kv. distribution substations. These ammeters could, of course, be used in a similar manner on other distribution voltages, but their greatest application would probably be on transformer banks supplying 2,300/4,000 or 6,900/12,000-volt distribution.

Socket Mounted

The standard vertical socket was used as a mounting and one-hole watertight service cable connectors are used to provide entrance and exit for the wires which connect to bushing and ground. A card can be inserted in the meter and in plain view advising against removal of the meter from the socket without the permission of some authorized person such as the meter or substation superintendent. Before removing the meter, the neutral lead from the transformer must be directly connected to ground, shorting out the ammeter.



THERMAL AMMETER provided with socket mounting

The total material cost of installing this type of ammeter is itemized below:

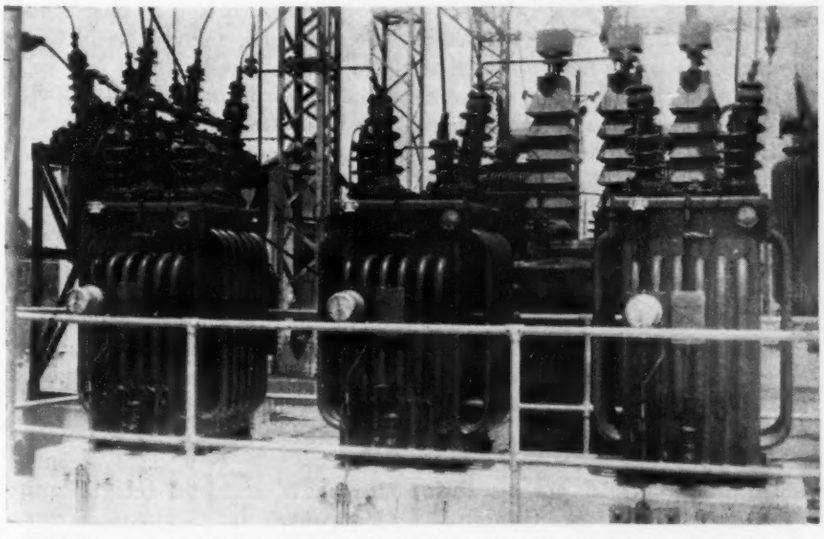
3 60 amp. thermal ammeters	at	$12.00	$36.00
6 No. 8/2 cable connectors	at	0.18	1.08
3 1-in. vertical sockets	at	1.37	4.11
Mounting plates, etc.			5.00
			$46.19

The conventional installation at present in one of our substations consists, on the other hand, essentially of the following items:

1 Standard outdoor inclosure	at	$15.00	$15.00
6 5-kv. porcelain bushings	at	0.45	2.70
3 5-kv. current transformers	at	21.44	64.32
50 ft. No. 6, 5,000-volt wire	at	0.06	3.00
3 5-amp. thermal ammeters	at	8.00	24.00
1 Meter inclosure	at	10.00	10.00
25 ft. 4-conductor control cable	at	0.13	3.25
Mounting devices, etc.			10.00
			$132.27

It is evident that in addition to the reduction in the material cost of this new type installation of about one-third that now in use, the labor cost will also be greatly reduced. The savings would be even greater where the practice has been to use outdoor type current transformers.

Summarizing, these ammeters of 60, 90 and 180-amp. capacity are applicable to grounded Y-connected, 2,300/4,000-volt transformer banks up to 1,250 kva. and 6,900/12,000-volt banks up to 3,700 kva.



THREE thermal ammeters on a bank of three transformers give three phase loadings

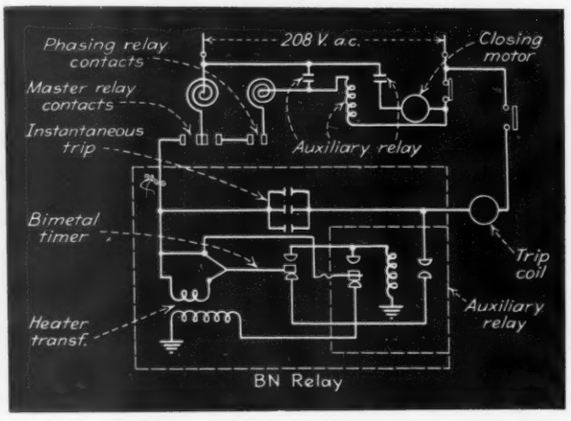
Network Protector Operations Reduced

Novel auxiliary control functions without sacrificing speed of clearing faults — Sensitive trip characteristic of master relay retained

W. W. EDSON, Boston Edison Company***
M. A. BOSTWICK,†* Westinghouse Electric & Manufacturing Company, Newark, N. J.

A NOVEL METHOD of eliminating excessive numbers of network protector operations has been developed on the basis of a scheme used for a number of years by the Boston Edison Company and which has proved to be superior to other methods of control now in use. Desensitized relay control has been achieved in various ways in the past; in this method, however, both the speed of clearing faults and the sensitive trip characteristic of the master relay are retained.

In the a.c. distribution network maximum dependability of the power supply and a minimum voltage variation are assured by energizing the grid of low-voltage cables through a number of relatively small transformer banks. These transformers are energized through several high-voltage feeder circuits, and the system is designed so that its entire load may be carried with one or more of these high-voltage feeders out of service. Feeder faults are disconnected without causing a service interruption by selective action of circuit breakers at the generating station and operation of network protectors (automatic circuit breakers) which are connected between the grid and network transformers. Network or grid faults are burned off by the explosive action of the high current in the low-voltage circuit. Since many of these networks cover an entire business district of a city, the number of protectors involved becomes quite large. Consequently, a simple method of de-energizing a given feeder is needed to facilitate the making of repairs or additions. This is accomplished by controlling both opening and closing of the network protector with a sensitive three-phase directional relay.



The relay consists of three overcurrent contactor elements that are connected so as to provide instantaneous tripping when current reversals are in excess of full load rating. An auxiliary relay and a thermal timing element included within the type BN relay provide a means of delaying all tripping operations when current magnitudes are below full load rating. This time delay is adjustable from one to five minutes. The timing element is compensated to avoid errors that may be introduced by variations in ambient temperature. Errors caused by the cumulative effect of many successive short time operations are similarly minimized by using both heating and cooling cycles of the thermal element.

FIG. 1—SCHEMATIC diagram of network protector control, including master, phasing and auxiliary timing relays

Relay Desensitized

When a feeder cable is disconnected at the power station it is energized in a reversed direction through the various network protectors. The master relays must be sensitive enough to operate and trip their associated protectors when energized with only the reversed magnetizing watts of their associated transformers. As a result of this sensitive tripping characteristic, and numerous momentary power reversals that may be encountered during periods of light load, an excessive number of network protector operations may take place. The new relay described in the following paragraphs is designed to eliminate useless protector operations and eliminate needless wear on the equipment.

In the past this function of desensitizing the master relay has been performed in a number of different ways, which will be summarized. It will be noted that many of these schemes have been deficient in that they have made the relay relatively insensitive, so that either manual operation of the protectors or special

* Head of station electrical design division.
† Engineering division.

switching operations were required at the power station to de-energize a feeder. Since many transformer vaults are located in apartment house basements, department store basements and similarly inaccessible places; manual operation is often difficult and costly. Special switching means are often impossible to obtain in existing power plant layouts, hence the new relay offers distinct advantages to the operation of distribution networks.

Desensitizing Methods

Desensitizing methods previously used:

1. *Method*—Mechanical restraint to obtain high reverse current setting.
Advantage—Simple, cheap, easily installed, good for relatively low settings.
Disadvantage—Restrains relay action during fault conditions, magnitude of settings limited, relay always insensitive.

2. *Method*—Auxiliary restraining element attached to master relay and energized through a delta-connected transformer so as to obtain restraining action that decreases during fault conditions.
Advantage—Restraint reduced in proportion to magnitude of voltage disturbance, relatively high settings obtainable.
Disadvantage—Relay insensitive during normal voltage conditions, restraining action is not eliminated during fault, not applicable to all relays.

3. *Method*—Auxiliary shunt reactors in current circuit, with automatic overload switch.
Advantage—Relatively high reverse current settings, relay made sensitive by action of overcurrent switch, readily applied to any relay circuit.
Disadvantage—Relay insensitive during normal conditions, overload switches on protector, difficult to test. Difficult to maintain overload switch contacts in current transformer circuits so as to get dependable performance.

4. *Method*—Mechanical restraint, removed by overload relay operation.
Advantage—Relatively high reverse current setting, relay made sensitive by action of overload relays.
Disadvantage—Relay normally insensitive. Not applicable to all types of relays, restraint and overload attachments mounted in different locations. Auxiliary springs and restraint device complicate master relay.

5. *Method*—Voltage restraint applied through phasing circuit, interrupted by positive phase sequence voltage relay.
Advantage—High reverse current settings obtainable without complicating master relay. Relay made sensitive during low voltage condition applicable to all types of Westinghouse relays. Only one moving part.
Disadvantage—Master relay insensitive during normal voltage condition.

6. *Method*—Voltage restraining applied through phasing circuit, interrupted by sensitive negative phase sequence overcurrent relay.
Advantage—High reverse current settings obtainable without complicating master relay, relay made sensitive by relative small unbalance in three-phase current, or by overcurrent, only one moving part.
Disadvantage—In systems having low voltage or relatively short feeders there may not be sufficient magnitude of negative phase sequence current in a backfeed to obtain positive action of negative phase sequence relay.

7. *Method*—Positive phase sequence master relay with positive and negative phase sequence control.
Advantage—A maximum of flexibility of relay control where sufficient negative phase sequence current is available in backfeed.
Disadvantage—In systems having low voltage or relatively short feeders there may not be sufficient magnitude of negative phase sequence current in a backfeed to obtain positive action of negative phase sequence relay.

Consideration of the above circuits and the nature of a majority of network applications reveals that the ideal operating characteristic would include:

(a) A sensitive tripping characteristic that will provide the ability to open a network protector after a reversal of transformer magnetizing watts has lasted for a period of, say, a few minutes.

(b) An instantaneous trip for current reversals in excess of full load.

(c) A device that can be applied to relay control circuits of any usual design.

(d) A device that can be set to permit continuous power reversals up to at least 40 per cent load if local conditions require it.

A characteristic of this nature is built into the type BN relay (Fig. 1).

Functioning of Relay

Operation of the device can best be understood by referring to the schematic diagram (Fig. 1), which includes control circuits for the master and phasing relays. It will be noted that the closing circuit of the protector is not involved.

First assume that the feeder is faulted and the reverse current has picked up two of the overcurrent elements. It will be noted that the trip circuit is instantaneously made through the master and overcurrent contacts of the two fault detectors operating in parallel. If the reverse current were of less than full load magnitude, the heater of the thermal element would have been energized as soon as the master relay contact closed. Heating would then continue until interrupted by action of either the master relay contacts or those of the auxiliary relay which is energized when the "hot" contact of the thermal timer is made.

One of the front contacts of the auxiliary relay then seals the relay in place, while the other sets up the trip circuit which will be made if the "cold" contact circuit is completed by the timer before the master relay contacts are opened. Note that opening of the master relay contacts can interrupt the timer at any point in its cycle. Furthermore, since the greater portion of the timing cycle is required to cool the thermal element, only a small part of the time can be lost as a result of heat being stored in the element by a number of successive operations.

The bimetallic element is energized

[*Continued on page 121*]

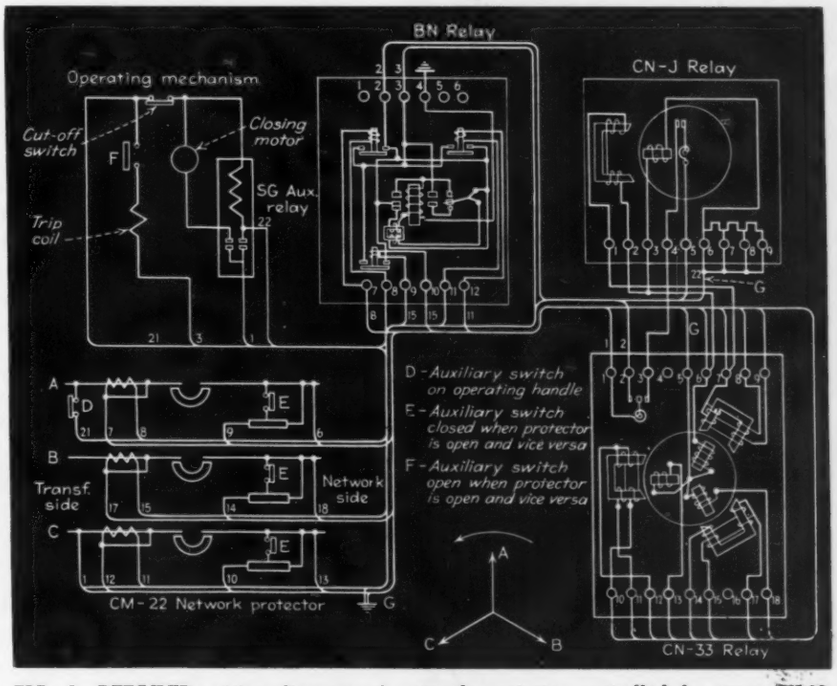
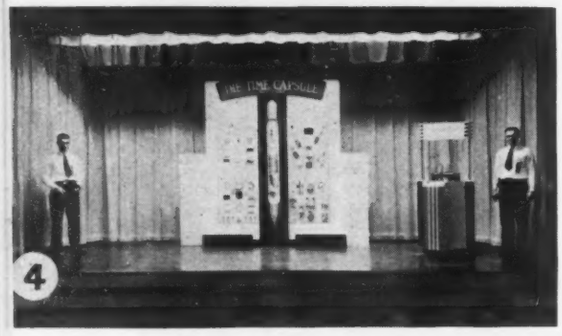


FIG. 2—DETAILED wiring diagram of network protector controlled by type CN-33, type CN-J and type BN relays

"SHUCKS, MISTER,

PUBLIC RELATIONS SERIES



THE little shaver with the dirty face and the droopy breeches just about summed up the situation for everybody.

All day long Kenosha people had streamed through the new $115,000 "public service building" where Wisconsin Gas & Electric was holding open house. They admired the spotless kitchen, exclaimed over the model living room and fingered the mysterious-looking linemen's tools.

Now it was 4 o'clock. School was out. Youngsters had taken possession and were gobbling up souvenir rulers and balloons at a great rate. Some were on their second trip through. Others, and the lad with the dirty face was among them, were on the third lap when the repeated appearance of certain familiar soiled faces caught the attention of jovial Harry Pauley, host and division manager.

His eyes twinkled as he turned to the man at his side.

"You know, Mac," his voice boomed, "I think I'll just catch some of these kids and brand them so we can find out how many times they are going through!"

There was a momentary silence as six pairs of eyes peered up at Pauley cautiously. The little shaver took a tighter grip on his two "extra" rulers and he tugged at the drooping leg of his corduroys.

"Shucks, mister," he grinned disarmingly, "we *like* the place."

And so they did—everybody liked the place. This was not the usual formal office building, with minor concessions to the convenience and comfort of customers shoe-horned into the design as an afterthought. Here was a true community building which, since its beginning, had been intended for the customers' use and, in the words of the dedication "to the aim of promoting 'better living' among the citizens of Kenosha."

Seven-eighths of this new two-story

1, 2 Main sales floor, which the company hopes shoppers will use as a convenient rendezvous. "If you plan to join friends downtown," its neighborly offer goes, "use the public service building as a meeting place."

3, 4 Fascinating to both men and women, at the open house, was the model kitchen in the second floor demonstration hall. Also in the hall are a stage for skits and complete modern projection facilities. It will be a meeting place for clubs and cooking schools.

5, 6 Mrs. Brehn, home-lighting adviser, visits with division manager Pauley in model living room during a lull in the open house. Valance over the table shields a fluorescent light source.

7 Sure attention-getter was the billing machine. Crowds kept the operator busy much of the time turning out sample bills and explaining how readings from route books are set up in the machine.

8 Effect of changes in fixtures and fixture spacing can be readily demonstrated by mounting them on the demonstration ceiling in the basement.

9, 10 The model store fronts in basement give Kenosha merchants interested in advanced display lighting a chance to try new ideas before using them in their own establishments.

11 Division manager H. M. Pauley in his mahogany-paneled office.

12 Unique architectural feature of the building is the continuous window across the face of the second story, where the accounting offices are located.

WE LIKE THE PLACE"

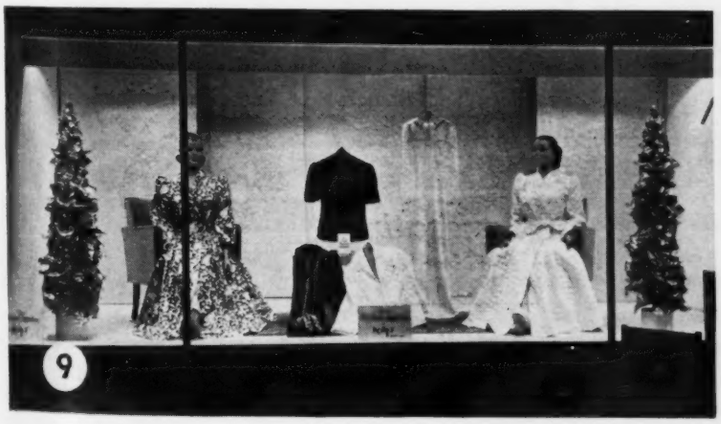
Wisconsin Gas & Electric Company opens its new $115,000 public service building to the public at Kenosha: 16,500 attend three-day open house

building is given over to facilities that Kenosha people can use. Here they can see, try out and attend demonstrations of the appliances and service that the company offers, hold group meetings, cooking classes and develop their own ideas in electric living under expert supervision.

For home makers, the second floor offers a comfortable hall with stage, projection equipment and model kitchen equipped with all the modern gas and electric kitchen appliances. There is a living room and a model home for home-lighting display and experimentation; also nurses' quarters, lounge, and the building's quota of offices.

For Kenosha merchants, business men and farmers the basement offers the best opportunity to try new store- and factory-lighting equipment, as well as farm and heavy commercial appliances. Besides the two model store fronts there is a flexible "experimental ceiling" where new commercial lighting fixtures can be mounted and moved about to try out the effect of spacing changes. Flexible sewer and heavy-duty electrical outlets in another basement room make it easy to set up and operate a complete commercial cooking establishment.

On the main floor the company hopes that the ample display floor will become the rendezvous and meeting place of shopping customers and has invited them to use it as such. Here modulated illumination, warm wall tones and modernistic appliance display sets are molded into a harmonious architectural whole. Soft brown and buff wall tones have been blended to harmonize with the floor and produce a pleasant contrasting background for appliance displays. The dual light-conditioning center has been disguised as a modern light "bar" (less the brass rail), while the cashier's counter and credit department are an inconspicuous part of the background.



Editorials

S. B. WILLIAMS, *Editor*

State Rights and Water Power

CONFLICT between the states and the federal government over the development, control and regulation of streams has come to a head. It was bound to happen as a result of the sweeping New River decision. The spark in the present instance is the proposal for an Arkansas Valley Authority which would extend its control over a watershed in excess of three hundred thousand square miles in Arkansas, Louisiana, Oklahoma, Texas, Kansas, Missouri, New Mexico and Colorado.

To fight this encroachment of the government upon states' rights the governor of Colorado invited the governors and water officials of sixteen states to a meeting earlier in the month. Some fourteen states were represented and of these thirteen voted to oppose any more power yardsticks west of the Mississippi.

A few years ago New England saw what was happening and opposed the government in the matter of flood control when it became apparent that the federal program would take from the states much of their remaining sovereignty. The concerted effort of that group of states was sufficient at the time to cause a retreat of the public ownership bloc in Washington. Will a similar concerted effort by these Western states be equally as effective at this time?

This AVA action might be considered the third attempt to carry out the socalled "Little TVA" program. It was first proposed to have these power authorities blanket the country. The proposal raised such a storm of protest that it failed.

Next came the flood control program, which was in reality but the same thing in different clothing. The animal under the cloak was recognized in time and once more it failed.

This time the most ambitious scheme of all, an authority in an area covering nearly a third of the United States, is proposed. Should it become a reality few states west of the Mississippi would be without government interference in local matters. For this whole thing is much bigger than power or water. These government agencies, once started, have so much money to spend and need so much to get their power sold that they become dominant politically. They also greatly affect the revenue of local taxing bodies.

There is no question but what the New River decision gives to the federal government much wider rights over streams than previously existed, nor is the government slow to take advantage thereof. On the other hand, merely because the government has these powers, can a handful of power-yard-stickists force upon the states something which they do not wish?

Courts Rule on Rural Inductive Interference

IN SEVERAL INSTANCES in the past year the courts have denied telephone systems built prior to rural electric lines any recovery because of inductive interference, on the theory that prior occupation cannot be used to deny public convenience and necessity and thus prevent progress.

These rural telephone lines in many instances reflect the desire of a rural section to have telephone service but because of the thinness of territory it could not afford anything but the most inexpensive installation. So long as there was no inductive interference the lines worked reasonably well. When electricity came in and trouble developed the telephone operators contended that since they were there first the newcomer should prevent any disturbance to the communication service. This sounds like a common-sense point of view except for the fact that the farm lines have never been improved. In a great many instances they are obsolete. On the other hand, the electric lines are of modern construction and will not cause trouble to modern telephone lines. Under these circumstances the courts are holding that the telephone operators do not have a leg to stand on.

While the cases that have come to our attention so far have all involved REA co-operatives, they nevertheless set a precedent which can be used by power companies. Yet since the rural telephone systems that have this trouble are for the most part small and locally owned, we cannot help wondering what the decisions might have been had the electric lines been owned by private utilities.

Age of Generating Equipment in Service

FOR THE FIRST TIME there is available a comprehensive summary of the age of generating equipment. These data, which are given in a Directory of Generating Plants, published by the Federal Power Commission, reveal a total capacity as of the first of the year of approximately 40,000,000 kw. Of this total, hydro accounts for 29 per cent, internal combustion slightly over 1 per cent and steam 70 per cent.

Ten per cent of all generators now in operation are more than 30 years of age, but these units represent less than 3 per cent of the total capacity. As would be expected, the bulk of the older equipment is in hydro, approximately two-thirds. The amount in internal combustion is negligible.

Of the 11.3 million kw. of hydro, 741,695 kw. was

installed prior to 1910 and another 2,278,992 kw. prior to 1920. Thus, 6 per cent of the hydro is more than 30 years old and all told about a quarter is more than 20 years old. Since in hydro there is little improvement in efficiency to be gained by generator design, the operating lifetime is indefinite under adequate maintenance. These figures, therefore, merely mean that the utility industry is generating its hydro energy from comparatively young plant.

When we come to steam, we find that out of a total capacity of 27.7 million kw., 371,545 kw. (1.3 per cent) was installed prior to 1910 and 4,813,202 kw. (17.4 per cent) was installed prior to 1920. This means that less than one-fifth of the steam capacity is more than 20 years old. Compared with almost any other industry that has been in existence over half a century, this is almost a record for modern equipment.

Machinery deteriorates by wear and tear and by obsolescence—inefficiency of operation in comparison with later designs. Maintenance can take care of the first, but only replacement will take care of the second. A rough gauge of steam power efficiency is fuel consumption. Last year the average was 1.36 lb. per kw.-hr. Ten years ago it was 1.55 and 20 years ago 3.39 lb.

Thus, the record shows that from the standpoint of fuel economy we are lengthening the number of years in which a generator may operate within the accepted range of economy.

There is another thing; these data reflect the modernization program which the utilities have carried on in the past six or seven years through the introduction of higher pressures and temperatures.

These data are of great value right now in any consideration of power adequacy for defense, because they indicate that, unlike the situation in machine tools, electric generating equipment is modern and able to carry the load. Very little, if any, reduction will have to be made for obsolescence.

Outages Report Themselves

OUTAGES on rural circuits can run into fairly prolonged interruptions if they occur in remote sections, particularly where telephone service is not universal. With the great expansion of rural service under the joint auspices of REA and the utilities there has arisen a call for some inexpensive form of automatic reporting apparatus which will notify a headquarters station that part of a sectionalized area has been deprived of service. The prompt information should go far to shorten outage time.

News comes from REA that an inexpensive device had been developed and is now being tried out in service. The sender transmits an 80-kilocycle carrier signal as far as 60 miles. The coded signal continues for three minutes and then stops, so that there will be no interference with other similar signals from other points that may be suffering an interruption in the same storm area. When service is restored the transmitter sends a two-minute signal to report the restoration.

Not the least of the potential benefits is the possibility of using the tape-recorded information afterward still further to co-ordinate the protective schemes and thus prevent recurrence of preventable outages. Certainly the immediate notice will inform an operating headquarters where trouble exists and thus permit most advantageous routing and disposition of maintenance forces. The device is described in this issue.

Ninety-nine Point Seven

ACCURACY of 99.7 per cent at three to four times the load for which a watt-hour meter is nominally built is today taken for granted. But it has taken close to five decades to reach that goal from the days of Shallenberger and his contemporaries, who hit upon that eminently versatile device—the induction watt-hour meter, which still clings to the basic principle that first gained acceptance as a.c. started to supersede d.c.

One man recently retired has spanned the whole of that period. W. H. Pratt started with Elihu Thomson in 1895 and up to two years ago had been primarily responsible for the design of 99.7 per cent of the induction watt-hour meters which had been produced by the General Electric Company and its predecessors. Meanwhile, W. M. Bradshaw has created almost as large a percentage of the Westinghouse watt-hour meters. They have earned the plaudits and the felicitations of their legion of friends among the utilities and their competitors.

And, as every one knows, the power companies, through their committees, have had a big hand in shaping the evolution of energy meters, perhaps more so than for any other piece of system equipment. Collaborators in these groups are three other veterans who are also retiring—Durfee of Rochester, Fellows of Washington and Cruikshank of Baltimore. They, too, have taken turns in setting practical goals for the manufacturers to meet.

Practically simultaneous retirement of these men marks a milestone in the meter art. But as a milestone is both a marker on the highway indicating the distance so far traveled and the beginning of a new stretch, so does this occurrence mark how far we have come in the development of the industry's cash register in the past half century and at the same time start a new era of progress. These men have given us as nearly perfect instruments as could be devised with our present knowledge, but they have left something much more valuable than that. Where there were but a handful of them at the start, they have left in their place hundreds skilled in their art and inspired with the same desire to push ahead further and further.

And in this thought there creeps in a feeling of religion—religion of business. If there is a life hereafter, a business life, and we think there is, it will not be found in a record of past accomplishment, but rather in the progress that comes from those who will take our places, whose thinking, whose dreams, whose ambitions we have been able to mold by our own efforts and inspirations.

First a Mickle, Then a Muckle

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

LET A CAMEL get its head under the tent, the old proverb goes, and before long the whole camel will be inside. And the obvious result is that the original occupant has less room, or has been forced outside.

That's what some observers are saying about the amazing increase in proposed expansion of steam generation, as compared with hydro, in government electric projects. Criticism is heard that the government is rather slow in recognizing facts capable of demonstration, that steam is cheaper than water power in many instances, though lacking in its appeal to the popular imagination. Political platforms and political oratory have made much of the public right to the natural blessing of falling water.

But the move is more significant than just indicating that the public power bloc has taken a long time to look a fact in the face. The camel under the tent idea is one worth studying, for there are many indications that as the government turns more and more to steam the privately owned utilities will have to face the invader on a new front.

It promises to be interesting. So far most of it is "incidental"—not a happy word to the last ditch opponents of government ownership, since it was "incidental power"—almost unavoidable in a dam project designed for navigation and flood control—which steered the TVA safely past the Supreme Court of the United States when that body was being called "the nine old men" by New Dealers.

Incidental in the Beginning

Steam generation is "incidental" for the next little period in the march of government ownership because it is being projected almost exclusively in areas where it is to supplement hydro power. Steam plants, it will be recalled, were projected even for Passamaquoddy.

But the development is a straw in the wind. It requires, of course, putting increasing emphasis on the economy of steam operation. It involves, to what will undoubtedly be an increasing extent, softening the arguments about public rights to natural gifts. As that line of political attack expands, getting away from both the "incidental power" and the natural blessing notions, it will unquestionably move slowly but surely over to the natural monopoly theory, so often used successfully, from a political standpoint at least, with respect to street car lines, subways, etc., and unsuccessfully, up to now, with regard to railroads and telephones.

Advantage Declines

While the controversy of public versus private ownership of the electric industry was confined almost exclusively to hydro developments, the government ownership advocates had a tremendous advantage. In fact, the advantage was so obvious that if the public power bloc had not insisted on the "yardstick" idea the fighting might have been much less bitter.

As David Lilienthal explained to the Congressional committee which investigated TVA, government ownership of a hydro development had private ownership under a terrific financial handicap. Part of the original cost of the development, he pointed out, could be charged off to flood control. Part of it could be charged off to navigation. The government, borrowing money on tax-exempt Treasury bonds, could obtain even the capital allocated to power at a rate far below that at which any private corporation could borrow. And, finally, there was the advantage in taxes, both federal and local.

Mr. Lilienthal did not say that no state, county or city would pay an annual sum to some private corporation because the dam that corporation had built protected state, county or city property from floods, but it's rather obvious. Nor did he stress the equally obvious fact that in the case of government operation it is unimportant whether or not the allocation to navigation is justified by such shipping as may develop on waterways improved by such dams. There is a long tradition in government river and harbor expenditures that the results do not have to justify the investment. No one really expects that, least of all the people who clamored for the original projects.

So, in any discussion as to whether any particular power site should be developed by public or private money, the battle was pretty nearly lost by the private utilities before it was begun.

But now that the government is turning more and more to steam the battle ought to be more interesting, both from the viewpoint of the observer with no selfish interest and on this matter of a yardstick. The government still will have certain advantages, notably on interest rates and taxation, but there can be no allocations of cost to navigation and flood control and irrigation.

Will Efficiency Decide?

Moreover, in steam production efficiency of operation is far more important, and it is precisely on efficiency of operation that the private utilities have always claimed a considerable advantage over public operation. In the case of hydro developments the big element of cost, of course, is interest on invested capital. It is the cost of the dam itself, and the reservoir which holds the impounded water, that is the big item. And it is precisely on these that the government's advantages apply most heavily.

This turning of the government more and more to steam was hurried by the national defense situation. Remember the Northeastern grid system, which was to cost $400,000,000? That plan embraced four huge steam

[*Continued on page 112*]

NEWS OF THE WEEK

Western States Alarmed at Public Power Growth

Colorado and Nebraska initiate moves to regain tax revenue from present exempted plants — Arkansas Valley Authority bill to meet with strong opposition in Congress

By DAN T. BRAYMER
Western Editor

All the necessary elements for a couple of brisk battles between the public and governmental authority exist in Colorado and Nebraska right now. Both pending scraps, in the last analysis, concern water—water that the people of these and surrounding states need for irrigation, but which public authority, either state or federal, seeks to use for public power generation—tax free.

Oppose AVA Bill

The struggle of the people of Colorado to retain water rights that the pending Arkansas Valley Authority bill would usurp, under the Supreme Court's "New River decision," promises to be of national importance. And if the people of Colorado can do anything about it the AVA bill will never get through Congress. The "New River decision," in effect, gives the federal government control of all rivers and streams which can be made navigable by the expenditure of any amount of money. Since the Arkansas River rises in the mountains of the Continental Divide in Colorado, the AVA bill would implement the recent court decision and deprive Colorado and other Western states of their sovereign rights to participate in the development and control of their natural resources.

The pinch comes in that waters rising in Colorado would be under federal control outside the state and owners of prior water rights granted by the state would be prevented from diverting water for their own use (irrigation purposes). Rights to prior use of water from streams and rivers in Colorado by citizens owning such rights have been established and upheld time and again in Colorado courts and protected by hard-bitten men with six-shooters since the early days of statehood. For in Colorado water rights are a form of property and oftentimes more valuable than land itself.

After seven successive dry years the rights to prior use of water under state law are going to be bitterly contested. Already Colorado's legislators in Washington have promised the folks back home that they will defeat the AVA bill. The recent meeting in Denver of five Western governors, a group of attorney-generals and water experts led by Gov. Ralph L. Carr of Colorado reached an agreement to oppose federal invasion of state rights by assuming complete jurisdiction over Western streams and rivers.

Essentially the situation in Nebraska is similar to that in Colorado. The people need and want water for irrigation. They have been willing to accept publically owned and financed water storage reservoirs for irrigation purposes. But they now find themselves without the irrigation systems and facilities that they need and want. Instead they are in possession of state-controlled, federally financed public power districts, which as government subdivisions are not taxable. These power districts are seeking to take over the state's privately owned tax-paying utility systems, to acquire steam-generating capacity with which to "firm-up" their utterly inadequate hydro generation facilities.

May Tax Public Systems

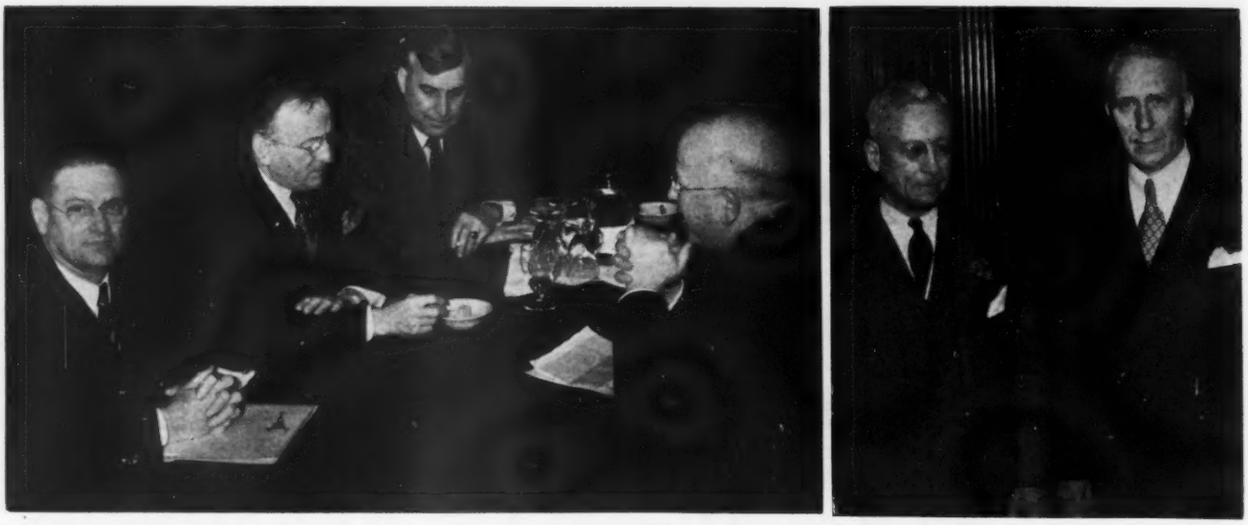
With the completion of the negotiations for sale of the Iowa-Nebraska Power Co. electrical facilities in Nebraska to the Consumers Public Power District for $19,465,000 this district will have spent $32,000,000 for the purchase of private power companies in the state.

Resurgence against the loss of taxes through purchase of private companies by "government subdivisions" is evident in action being taken at this session of the Nebraska Legislature to amend the state Constitution to make government subdivisions taxable. Such action, if successful, may reduce the net annual income the public power districts derive from operation of the private systems to the point where the financial backing of the pending Iowa-Nebraska deal may be withdrawn and negotiations fall through as they did two years ago.

Under the existing Nebraska Constitution government subdivisions are not taxable. However, some legal opinion in the state holds that governmental

EEI Defers SEC Vote

Decision of trustees of the Edison Electric Institute regarding registration with SEC under Section 13 of the Utility Holding Company Act has been postponed until the March meeting. The trustees were due to meet in Chicago last week, but Washington matters, illness and press of other matters prevented a quorum of members from being present.



COMMITTEE SESSION—Seen during the E.E.I. electrical equipment committee meeting in Detroit last week. L. to r., at the conference table, are Stanley Stokes, Union Electric Co. of Missouri; R. W. Wilbraham, United Engineers & Constructors; W. F. Nimmo, Virginia Electric & Power Co., Richmond, and H. P. Seelye, Detroit Edison Co. At right is N. Stahl, Pennsylvania Power & Light Co., Allentown, and H. W. Eales, Public Utility Engineering & Service Corp., Chicago

authority in this case is acting in a proprietary capacity and is therefore legally taxable. To get around this pending court decision, a bill was passed last year under which the public power districts of the state pay, "in lieu" of taxes, an amount equal to the taxes on the private property during the year prior to its acquisition. However, if the power district does not make sufficient money to pay this amount there is no lien on the property.

There are some signs to be noted that would lead observers to expect an investigation of the income of certain public power district officials in the near future. However, no action has yet been taken in the Nebraska Legislature to initiate such a move.

•

SEC Chairman Frank Named to Judgeship

Appointment of SEC Chairman Jerome N. Frank to the Federal Circuit Court bench in New York involves practically no chance of a major shift in policy on utility integration. Release of the U.G.I. "blueprint" report has committed SEC to the narrow viewpoint in applying the "death sentence" provision.

Considerable jockeying is going on to determine whether Commissioner Edward C. Eicher of Iowa, former New Deal congressman, or Commissioner Sumner T. Pike of Maine, considered a liberal Republican, will be the next chairman, the fifth since SEC was organized. Reports have been that Mr. Eicher is in line for a federal judgeship.

Power Requirements of Steel Mills Aired

Lively discussions centered last week around papers on steel mill power requirements and the relative merits of masonry and metal inclosures for central station switchgear at the single open session of the E.E.I. electrical equipment committee meeting in Detroit.

In the first of a series of papers covering electrical systems of basic industries F. W. Cramer, Carnegie-Illinois Steel Corp., found it generally uneconomical for steel mill operators to install highly efficient boiler-turbine generating plants. The high thermal economy of such expensive facilities, he asserted, merely leads to wastage of the extra blast-furnace gas that their expensive efficiency makes available.

Circuit breaker duty in steel mills Mr. Cramer found much more severe than on utility systems; sufficiently so, in fact, to justify special considerations of steel mill breaker needs in setting up industry breaker standards.

Participating in a three-paper symposium on the merits of masonry vs. metal partitions for protective isolation of switchgear, C. M. Gilt, Consolidated Edison Co., declared that experience with metal-inclosed buses at Waterside station had confirmed his company's favor for metal-inclosed main generator buses where the housings are mounted independent of and separate from circuit breakers. Don Taylor, Public Service Electric & Gas Co., reported that experience of his company with masonry cell construction in four main generating stations and some 70 substations had been sufficiently satisfactory to justify continued use.

In presenting his company's views, A. T. P. Fugill, Detroit Edison Co., stated that for 4,800-volt service metal partitions afford sufficient protective isolation between breakers and bus for individual circuits, but different bus sections should be separated by masonry walls or equivalent.

Nicholas Stahl, Pennsylvania Power & Light Co., described the power supply to a large testing transformer installation to be used by Roller Smith Co. in testing circuit breakers. The arrangement is to be used for breaker short-circuit tests up to 250,000 kva. Mr. Stahl outlined the contract restrictions governing the testing operations that were set up to insure minimum disturbance of the utility system.

•

Reports Record Sales

The Columbus, Ohio, municipal light plant set an all-time high in 1940, with receipts from the sale of electricity totaling $880,000, being $42,000 more than was recorded for 1939, Robert N. Tucker, superintendent, has announced.

•

Seeks Bonneville Power

The sponsors' committee of the Baker County, Oregon, PUD have filed application for 7,000 kw. of Bonneville power. The Oregon State Hydro-Electric Commission has reported that formation of the PUD is feasible. Efforts are being made to purchase the facilities of Eastern Oregon Light & Power Co. The proposed district comprises 457 square miles and has a population of 12,355.

Georgia Power Launches Giant Refinancing Plan

Will sell $101,271,000 of mortgage bonds and borrow $13,500,000 from New York banks to refund $124,483,700 of obligations — C. & S. to make capital contribution to subsidiary

A hundred-million-dollar refinancing program to reduce debt and lower its interest charges is to be undertaken by Georgia Power Co., subsidiary of Commonwealth & Southern Corp.

The southern utility has filed with the Securities and Exchange Commission a statement covering $101,271,000 of first mortgage bonds, due in 1971, to be sold either to underwriters for sale to the public or to 20 or 30 institutional investors. The proceeds, together with $13,500,000 of New York bank loans and other funds, will be used to redeem seven issues totaling $124,483,700, including $115,166,000 of first and refunding mortgage gold bonds, 5 per cent series, due 1967.

Will Acquire Bonds

In the proposed plan Georgia Power is to acquire $34,231,000 of its 5 per cent bonds held by Commonwealth & Southern. C. & S. is to make a cash contribution of $14,337,319 to Georgia Power and also to surrender for cancellation, without compensation, its holdings of 7,856 shares of $6 preferred and 45,430 shares of $5 preferred stock of Georgia Power.

Preston S. Arkwright, Georgia Power president, stated that when the refinancing program is completed "we won't owe as much money as we did before. The most important result will be our improved capital structure."

The cash payment of Commonwealth & Southern, together with the equivalent value of the preferred stocks to be surrendered, will increase the stated capital represented by the 2,500,000 shares of Georgia Power common stock, all owned by C. & S., from $87,777,002 to $106,448,198, an increase of $18,671,196.

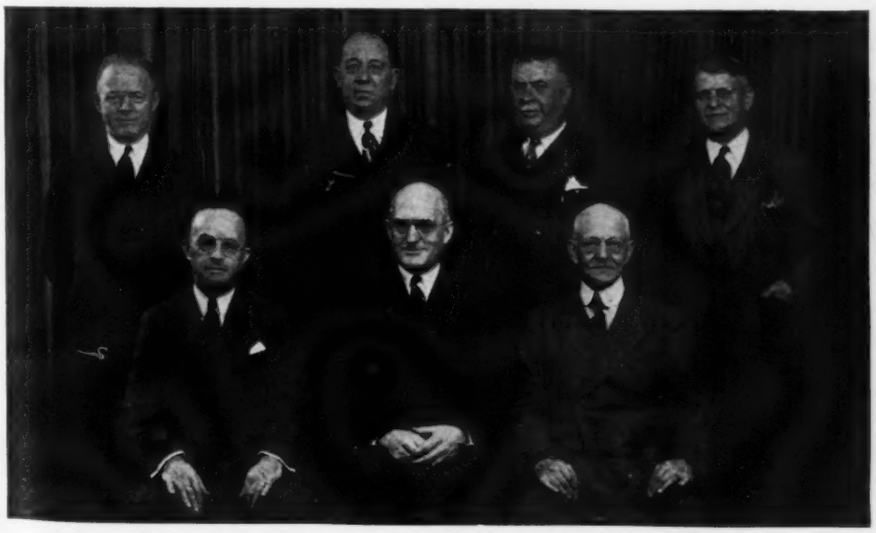
However, Mr. Arkwright said, adjustments are to be made in the company's books whereby the stated value of the common stock will be reduced to $55,000,000, or $22 a share. The sum of $32,448,955 will be deducted from the company's plant account, or the book value of its property, which amounts to a write-down of that amount in the capitalization. The remaining $19,000,000, representing the difference between $32,448,955 and $51,448,198, will be added to the stated value of the company's preferred stock and to the reserve for depreciation.

In SEC circles the view is taken that after the new bonds have seasoned and the savings in interest reflected in higher earnings, Georgia Power should refund the outstanding preferred stock. The new preferred will be given an opportunity to season and higher earnings reflected for the common stock, then C. & S. should proceed to sell its equity in Georgia Power. The same process is proposed for Alabama Power, Mississippi Power and South Carolina Power companies. This would mean the complete liquidation of all southern properties held by the holding company and make them independent operating companies without holding company control. The argument in SEC circles is that these properties, individually or as a whole, with holding company ties, are too large for effective local regulation.

•

Seeks to Amortize

Florida Power Corp. has applied to the Federal Power Commission for permission under Balance Sheet Accounts Instruction 6-E of the commission's Uniform System of Accounts to amortize in equal monthly installments, by charges to income account at the rate of $72,000 annually, the unamortized debt discount and expense in the amount of $216,876 plus call premiums of $38,660 applicable to its 5 per cent sinking fund debentures due December 1, 1946, presently outstanding in the principal amount of $1,933,000, which the company proposes to redeem at the earliest practicable date.



MARCH OF LIGHT—Lynn Gas & Electric Co. officials sponsored the "March of Light," a presentation attended by 1,200 last week at the General Electric auditorium, which featured by tableau and drama the development of artificial light from primitive flame to modern illuminants. L. to r., front row—H. Morris Kelley, president; James A. Cook, general manager; Eugene B. Fraser, treasurer. Standing (l. to r.)—A. B. Whitehouse, superintendent electric distribution and producer of the program with the aid of the Lynn Gas & Electric Players; E. W. Allen, merchandise manager; J. W. Lingary, superintendent electric plant; I. A. Patten, general superintendent, electric department. The Hygrade-Sylvania Corp. and Champion Lamp Co., co-operated in the program. Moorhead Wright, Jr., General Electric, was assistant producer, aided by J. Arthur Melanson. Other sponsoring groups were the Lynn section, A.I.E.I., and New England section, I.E.S. At right is the feature tableau—"Torch of Civilization," posed by Marion H. Kidder

AT P.E.A. JOINT MEETING—Seen during the joint meeting of committees of the Pennsylvania Electric Association last week in Pittsburgh. At left (l. to r.)—W. H. Wade and C. A. Dougherty of Pennsylvania Edison; E. C. Stone, president of P.E.A., and H. A. Randall, Duquesne Light. At right (l. to r.)—A. N. Shealy, Pennsylvania Water & Power; C. A. Dougherty, Pennsylvania Edison; C. N. Clark and H. A. Randall of Duquesne Light, and W. H. Jones, chairman of T. & D. committee of P.E.A.

Pennsylvania Group Airs Problems in Lightning

Sets faultless performance as goal — Explores efficacy of shielding, buried counterpoise, aerial coupling wire, wood arms and gapped arresters for lines and terminals

Asked to rebuild a 66-kv. steel tower line to be highly resistant to lightning and avert the need for a wholly new line at a cost of more than $1,000,000, the engineers of Duquesne Light Co. adopted a novel combination of raised overhead ground wire, conductors supported from four-member wood frames and an aerial counterpoise or coupling wire. Description of the line and the engineering reasoning behind it constituted the high point in an all-day joint session of the transmission and distribution and the electrical equipment committees of the Pennsylvania Electric Association in Pittsburgh last week.

Lightning Experience

In presenting information on seven years of lightning experience on lines of 66 to 220 kv., S. K. Waldorf (Pennsylvania Water & Power) said that surges had been kept out of the stations, but questioned whether even a counterpoise would afford perfect protection for lower-voltage transmission unless the insulation level is substantially raised. He felt that the tower-drop theory is reliable up to the point where surge impedance takes precedence over ohmic resistance.

Experimental and theoretical consideration of the shielding effect of overhead ground wires were combined by G. D. McCann (Westinghouse) to show the distribution of strokes to conductor and protection wire. He drew the conclusion that 30 to 40 or even 50 deg. was a permissible protection angle for lines in flat terrain, but that less than 30 deg. was indicated for lines in mountainous country.

In the discussion, E. R. Whitehead (Duquesne Light) found that he had to add from 3 to 4.66 ohms to measured tower footing resistances to cover the added effect of the induced charges in order to attain a true flashover potential value.

So far experience indicates that the material of which a counterpoise is constituted is immaterial as to electrical efficacy, but probably life and unattractiveness as to pilfering often influence the decisions, said W. W. Lewis (General Electric).

For complete protection the counterpoise must be accompanied by adequate shielding of the conductors by overhead ground wires and the footing resistances reduced so that the insulator flashover value will not be exceeded by the product of tower current and resistance.

Use of the counterpoise itself as the reference value in mountainous territory was advocated by D. R. Pattison (Pennsylvania Electric), who also asked how one could know, in making resistance measurements, that the test probes really reach conductive earth.

Rational insulation from the standpoint of the manufacturer embraces several factors not wholly reducible to simple quantitative analysis, said C. A. Woodrow (General Electric). The moderate voltage power transformer has inherently high impulse strength at relatively low cost. Also, many of the older breakers with large material separations had large margins of impulse strength. Mr. Woodrow felt that standardization would contribute most benefits if it allows flexibility for developmental introduction of new knowledge.

Average transmission distance on the 23-kv. subtransmission system of Duquesne Light is approximately 2 miles and this means that most direct strokes to the line will be less than a mile from some substation. E. R. Whitehead pointed out that it is thus possible for very high voltage waves to reach the station and result in arrester discharge currents having high rate of rise. He offered an antidote in the form of a 20-microhenry choke on the station side of the back-up gap.

The proposal was said by Mr. Whitehead to have no significance for large higher-voltage stations because the usual separations introduce bus and lead length inductances, which inherently serve the same purpose as the added inductance proposed for more compact arrangements.

•

Joseph M. Burchill Dies

Joseph M. Burchill, a vice-president and a director of the American Gas & Electric Co. and of the American Gas & Electric Service Corp., New York, died February 15 at his home in Forest Hills, Long Island, after an illness of three months. He was 46 years of age.

Line Failure and Series Capacitors PEA Topics

Galloping conductors, transformer loadings, pole inspections, experience with new weatherproof wire discussions hold attention of transmission and distribution group at Pittsburgh

Troubles with series capacitors and conductor galloping contrasted with benefits from transformer loading tests and pole inspections in the sessions in Pittsburgh last week of the transmission and distribution committee of the Pennsylvania Electric Association. Preliminary results of annual round-ups were discussed. Thus Eduard Fritz (Pennsylvania Water & Power) told of two cases of 66-kv. conductor failure due probably to snow collecting on the windward side and acting like an airfoil in the relatively high wind which followed.

Power Line Failures

Preliminary data on power line failures at crossings covered by agreements indicate an average rate of once in every 400 to 500 years. On transformer loading J. S. Maloy (West Penn) reported on 4,463 units tested with two Maximeters during the 1939-40 winter; 15.7 per cent have 50 per cent load or less, 41 per cent fall between 51 and 100, 32 per cent between 101 and 150 and 11.3 per cent were loaded above 150 per cent.

Limited experience has been had with some of the new types of weatherproof wire, but the hope was expressed that it might minimize tree transients, etc. There was some doubt of the ability to stand sharp bends without cracking. P. H. Robinson (Metropolitan Edison) has found cracks in the wraps of old street-light conductors which admitted water, the conductor parting by corrosion. C. C. Farrell (Philadelphia Electric) reported tests in progress revealing copper corrosion at exposed ends.

C. C. Mola (Potomac Edison), while still kindly to series capacitors, acknowledged an obstinate case of a one-volt flicker from a 5-hp., single-phase RI motor driving an ammonia compressor, cycling at 10 per second. J. S. Maloy said West Penn had good results from putting 4 ohms across the 2- to 3-ohm capacitors in a similar case of a 60-hp. motor which would not run above half speed when the 440-volt shunt capacitors were put in series voltage correction. The new attachments for induction regulators to ride through cyclic fluctuations were welcomed.

Personal equation was regarded as a sizable factor in pole inspections, but in general the failure experience confirms the inspection reports to the extent of from 60 to 70 per cent.

At the luncheon, on the day of the joint lightning session with the electrical equipment committee, E. C. Stone, president of P.E.A., told the engineers that Pennsylvania companies would undoubtedly pay more in taxes than in wages and that utilities deserved special recognition to equalize the incidence of taxes, now peculiarly burdensome because of their inherently large ratio to net income. He also deplored the tendency to arrive at depreciation by formula rather than by application of sound business judgment. He said engineering competency and economy are now more urgently needed than ever.

•

Battle Opens to Gain Control of Two Utilities

Battle for control of the million-dollar Central States Utilities and Central States Power & Light corporations between Frank J. Lewis of the Federal Reserve Bank of Chicago and Floyd B. Odlum, president of Atlas Corporation, New York, broke out anew last week during a special master's hearing.

Conflict is the outgrowth of a contract drawn on December 18, 1939, between Mr. Lewis and the trustee of the Utilities Power & Light Corp., which provided for Lewis' purchase of the securities and control of Central States Utilities and Central States Power & Light corporations for $1,600,000.

•

Conferees Hit Snag in Puget Sound Deal

Recommendation that condemnation proceedings be instituted against certain properties of Puget Sound Power & Light Co. was made this week to public utility districts in the state of Washington by A. G. Ziebell, president of the Puget Sound Utility District Commissioners' Association.

It appears that a stalemate has been reached between representatives of Bonneville and the Washington PUDs and officials of Engineers Public Service Co. and Puget Sound Power & Light Co. in negotiations for sale of the private utility facilities.

Some time ago conferences were held in New York and then shifted to Seattle. Last year an offer of $83,000,000 was made for the properties, but the utility considered that the price deserved no serious consideration.

President Frank McLaughlin of Puget Sound stated that Bonneville has not presented to the company a workable plan for acquisition of its properties.

SPEAKERS—At the joint meeting of electrical equipment and T. & D. committees of the P.E.A. last week in Pittsburgh speakers on the interesting program included (l. to r.) G. D. McCann, Westinghouse; Dr. W. W. Lewis, General Electric; E. R. Whitehead, Duquesne Light; W. H. Jones, chairman of T. & D.; H. A. Randall, chairman of electrical equipment group; Dr. S. K. Waldorf, Pennsylvania Water & Power; C. A. Woodrow, General Electric, and W. R. Metzger, Duquesne Light

Lighting Conference Held for Engineers

A lighting conference for power engineers last week drew 110 utility power salesmen to Chicago to hear a group of lighting authorities discuss the technology and economics of industrial lighting for production. The conference was under the sponsorship of the Chicago Lighting Institute's committee on education.

G. K. Hardacre, Public Service Co. of Northern Illinois, who discussed lighting economics, showed that economic analysis of various forms of lighting favor fluorescent in the industrial field because of the energy cost element—industrial energy is low rate and burning hours are long. He warned, however, that the real economics of lighting for production are not so much a matter of which form of lighting is cheapest but what relation the cost of good lighting bears to total plant investment, payroll or production costs when considered with the benefits it brings.

J. L. Stair, Curtis Lighting, pointed out that four basic points should be considered in designing office and drafting room lighting for industry: (1) The severity of the task: (2) duration; (3) continuity, and (4) contrast encountered. He warned engineers to avoid the assumption that either incandescent or fluorescent lighting is the only lighting for offices and draft rooms.

Holt Steele, Benjamin Electric Co., discussed considerations involved in protective lighting for industry.

D. P. Wood, Public Service Co. of Northern Illinois, urged power engineers to design their lighting installations assuming poor maintenance, but to point out at every opportunity the loss of light to the customer if lamps are not maintained.

Edwin D. Tillson, Commonwealth Edison Co., predicted that power engineers would, in future, see more and better lighting than they have ever seen before. Fluorescent, he stated, is going to do a lot more for us, and for industry, than incandescent ever has.

•

Utility Gets Lighting Facilities from City

Pennsylvania Public Utility Commission has approved an agreement between the city of Wilkes-Barre and the Pennsylvania Power & Light Co. which provides for the sale by the city to the utility of street-lighting facilities for $10,500, exclusive of the cost of removal.

The facilities had been installed and are owned by the city and used by the company in connection with street-lighting service to the city. A new contract has been entered into between the city and the company providing for the furnishing of street-lighting service, which includes the furnishing of all facilities by the company.

•

Suggests Sliding Scale Plan for Rate Making

A suggested plan of a sliding scale system for figuring electric rates has been offered to trustees of Associated Gas & Electric Co. and officials of Edison Light & Power Co. of York by the Pennsylvania Public Utility Commission.

The plan is to adjust the rates every year on the basis of performance in the preceding twelve months, passing along profits above a certain percentage fixed by officials of the utilities and the commission.

MEETINGS

American Society for Testing Materials—Spring meeting, the Mayflower, Washington, D. C., March 4-5; committee week, the Mayflower, March 3-7. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Southeastern Electric Exchange—Engineering and operation section, DeSoto Hotel, Savannah, Ga., March 13-14; annual conference, Bon Air Hotel, Augusta, Ga., May 1-3; J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

Oklahoma Utilities Association—Annual convention, Tulsa, Okla., March 17-18. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

Northwest Electric Light and Power Association—Annual meeting, Business Development Section, Davenport Hotel, Spokane, Wash., March 27-29. Daryl B. Leonard, chairman, Pacific Power & Light Co., Yakima.

Edison Electric Institute—Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 31-April 3. Major H. S. Bennion, managing director, 420 Lexington Avenue, New York, N. Y.

American Society of Mechanical Engineers—Spring meeting, Atlanta, Ga., April 1-3, C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Accounting Conference—American Gas Association-Edison Electric Institute, Netherland Plaza Hotel, Cincinnati, Ohio, April 7-8.

Midwest Power Conference—Fourth annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles N. Nash, conference secretary, Illinois Institute of Technology, 3300 Federal St., Chicago, Ill.

Electrochemical Society—Spring meeting, Cleveland, Ohio, April 16-19. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Greater New York Safety Council—Annual safety convention and exhibit, New York, N. Y., April 22-25. Greater New York Safety Council, Inc., Lincoln Building, 60 East 42d St., New York.

Missouri Association of Public Utilities—Annual convention, Elms Hotel, Excelsior Springs, Mo., April 23-25. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Illuminating Engineering Society—Pacific sion, second annual lighting conference, Pacific Gas & Electric Co. auditorium, 245 Market St., San Francisco, April 25-26. William P. Bear, general chairman, 245 Market St., San Francisco.

National Electrical Wholesalers Association—Annual convention, The Homestead, I Springs, Va., May 18-22. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

NEWS BRIEFS

PRINCETON UNIVERSITY PRANKSTERS pulled a fast one on students last week by sending out electric bills in the name of the "University Power Plant" in sums ranging from 15 cents to $65 demanding satisfaction immediately for "unpaid killowatt-hours." It was a long-planned and neatly executed practical joke which was discovered when about 700 called around to pay the bogus bills. "Have you paid your electric bill?" is a favorite greeting now, with a reply of "Watt bill?"

MEETINGS AND OBSERVANCES commemorating the ninety-fourth anniversary of the birth of Thomas Alva Edison were held last week in many parts of the country. In New York the inventor's widow and son, Gov. Charles Edison of New Jersey, were at the luncheon of the Edison Pioneers. One hundred and seventy of the pioneers were present. Edwin W. Hammer is the new president.

TVA IS GETTING A BOOST of $4,800,000 over original budget estimates. The independent offices appropriation bill shows TVA to get $69,800,000.

GOV. COOPER OF TENNESSEE has asked the General Assembly to give serious consideration to methods of replacing the $693,000 loss annually of the utility tax that private companies paid before being converted to public-ownership.

NOLAN WALTER, New Mexico State bank examiner and member of a special committee set up to study utility regulation, is making a report to Gov. John Miles recommending legislation. Utility legislation has been bitterly fought in the past.

•

Private Utility Sold

The last privately owned power company in northeast Mississippi went out of existence last week when the Tri-County Power Co., owned by the West Memphis (Ark.) Power & Water Co., was taken over by the Four-County Electric Power Association and the Natchez Trace Electric Power Association.

•

Consider LCRA Issue

An issue of $20,300,000 Lower Colorado River Authority revenue bonds now held by the Reconstruction Finance Corp. is under discussion for public distribution. Details of the financing have not yet been worked out.

Energy Production Stays at High Level

Production of electricity by the electric light and power industry declined less than seasonally in the week ended February 15 and was 2,810,419,000 kw.-hr., a gain of 13.5 per cent over the corresponding week of last year, according to Edison Electric Institute.

Output in the most recent week showed an increased margin over 1940 for the third consecutive week, the figure of 13.5 per cent being the largest since the week ended January 13, 1940. All of the major geographic regions also showed increased percentage gains over the preceding year in the week ended February 15.

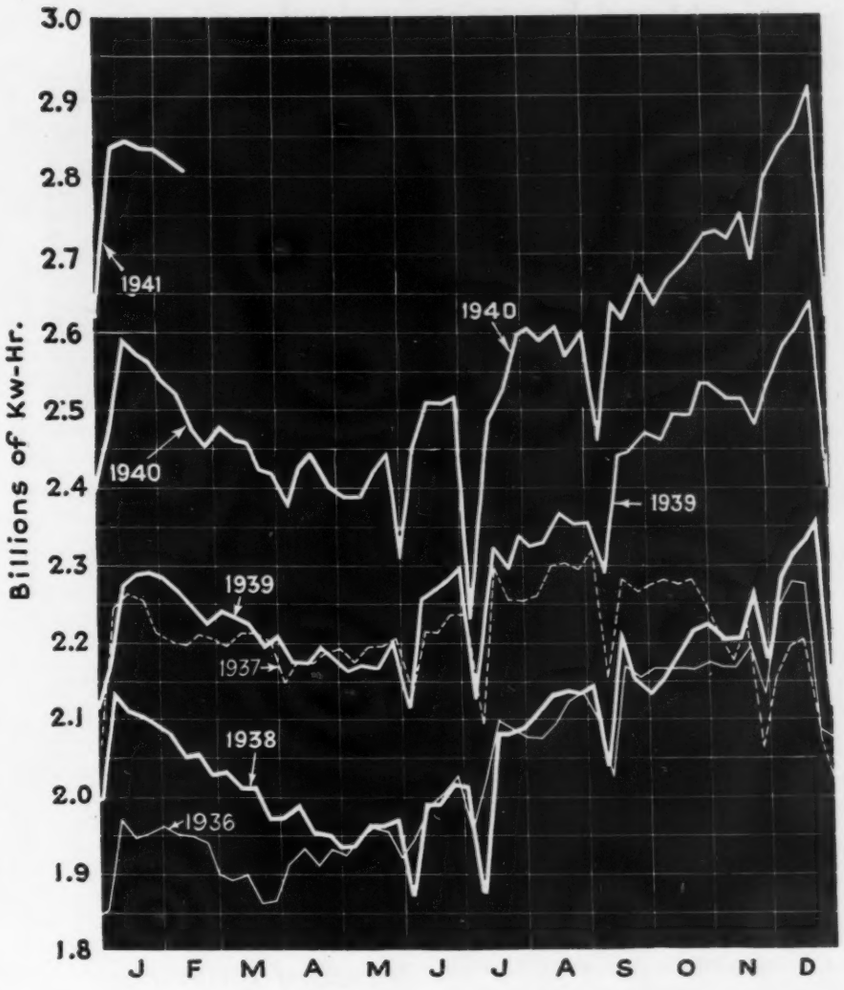
The margin of 16.5 per cent for the Central Industrial area, accounting for 31 per cent of the total output, was the largest since the week ended August 3, 1940. That of 11.7 per cent for the Middle Atlantic region, which accounts for 23 per cent of the total output, was the largest since the week ended January 13, a year ago. And that of 13.2 per cent for the Pacific area, accounting for 11 per cent of the total, was the largest since the week ended May 13 of last year.

Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Feb. 15	2,810	Feb. 17	2,476	Feb. 18	2,249
Feb. 8	2,824	Feb. 10	2,523	Feb. 11	2,268
Feb. 1	2,830	Feb. 3	2,541	Feb. 4	2,287
Jan. 25	2,830	Jan. 27	2,566	Jan. 28	2,293
Jan. 18	2,844	Jan. 20	2,572	Jan. 21	2,290
Jan. 11	2,835	Jan. 13	2,593	Jan. 14	2,270
Jan. 4	2,705	Jan. 6	2,473	Jan. 7	2,169
1940		1939		1937	
Dec. 28	2,623	Dec. 10	2,404	Jan. 1	1,998
Dec. 21	2,911	Dec. 23	2,641	Dec. 25	2,085
Dec. 14	2,862	Dec. 16	2,605	Dec. 18	2,202

Per Cent Changes from Previous Year

	Week Ending		
	Feb. 15	Feb. 8	Feb. 1
New England	+14.0	+10.5	+ 8.5
Middle Atlantic	+11.7	+10.8	+10.9
Central Industrial	+16.5	+15.0	+15.9
West Central	+ 8.8	+ 7.0	+ 9.8
Southern States	+13.3	+12.3	+10.0
Rocky Mountain	+ 7.5	+ 5.5	+ 3.9
Pacific	+13.2	+11.0	+ 7.5
United States	+13.5	+11.9	+11.3



FPC Orders Detailed Report on Activities

The Federal Power Commission, upon consideration of its investigation and hearings concerning accounting disposition of expenditures incident to political activities by five electric utilities operating in the state of Washington, has ordered that each of the companies file under oath this week full detailed reports of estimated expenditures relating to such donations, salaries, fees or other compensation for the year 1941.

The companies involved, each included in the commission's investigation and public hearings, which were held over a period of several weeks beginning at Seattle on October 14, 1940, are Northwestern Electric Co., Pacific Power & Light Co., Portland General Electric Co., Puget Sound Power & Light Co. and Washington Water Power Co.

The commission stated that any changes, additional expenditure or commitment shall be reported promptly.

•

Board Orders Utility to Make Charge-Offs

Federal Power Commission has ordered the Monongahela West Penn Public Service Co., Fairmont, W. Va., to charge off $5,815,630 of its electric plant adjustment account and $1,871,960 of its gas plant adjustment account. At the same time the commission ordered the company to transfer from capital surplus to a special reserve $2,169,035, the amount remaining in the electric plant adjustment account after the foregoing charge-off has been made.

The Public Service Commission of West Virginia has passed a similar order, except that it did not require the setting up of a special reserve of $2,169,035.

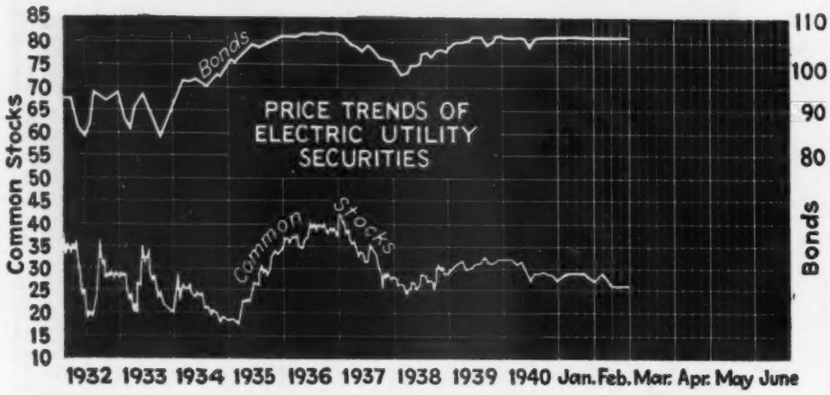
Seek to Avoid Strike of Utility Employees

Efforts are being made to settle differences between Consumers Power Co. and the International Brotherhood of Electrical Workers (AFL) before the 30-day notice of intention of 3,100 employees to strike runs out the early part of March.

Governor Van Wagoner has appointed a special commission to hear the differences and to mediate issues. The union first asked for a horizontal raise of $5 a week for all employees. Later this was extended to a closed shop and when the company refused the union asked for the check-off system. The company declared it could not agree to this system.

Last September the IBEW was chosen as the collective bargaining agency for the electrical workers in the third election held by the NLRB, nosing out the CIO union.

Light and Power Securities Lose Ground


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1932 1933 1934 1935 1936 1937 1938 1939 1940 Jan. Feb. Mar. Apr. May June

Following the general trend, utility securities drifted to lower ground this week. "Electrical World" stock index dropped from 26.4 the preceding week to 25.6, the lowest point in many months. Bond index, 105.7; last week, 106.0; last year, 106.2

American Gas Plans $7,500,000 Loans

American Gas & Electric Co. has advised the Securities and Exchange Commission of a proposal to make open account loans totaling $7,500,000 at 3¼ per cent interest to four subsidiaries.

The borrowers and the amounts listed are: Atlantic City Electric Co., $2,500,000; Indiana General Service Co., $1,000,000; Indiana & Michigan Electric Co., $2,000,000, and the Ohio Power Co., $2,000,000.

The subsidiaries will use the money to meet, in part, the costs of property additions pending permanent financing, the declaration stated.

American Gas & Electric disclosed that it plans to make capital contributions to or additional common stock investments in two subsidiaries. These were listed as the Wheeling Electric Co., $2,458,500, and Kingsport Utilities, Inc., $100,000.

This week SEC authorized the proposal.

•

Holders Exchange Stock

The First Boston Corp. and the Wisconsin Co., joint heads of the underwriting group which offered Wisconsin Public Service Corp. 5 per cent preferred stock, announce that the stockholders of the company, mainly resident in the territory served, have agreed to take 90,177 shares of new 5 per cent preferred stock in exchange for their holdings of old preferred stock pursuant to the terms of the company's exchange offer. This represents an exchange slightly better than 76 per cent of the 118,500 shares available to present holders.

•

January Offerings Total $34,500,000

New offerings of electric light and power securities during the month of January reached a total of $34,500,000. This compares with $212,875,000 in December, 1940, and $96,518,300 in January, 1940.

With the exception of the $5,000,000 bond issue of the Central New York Power Corp., which was placed privately, all the offerings were for refunding purposes.

The largest individual issue was offered by the Consolidated Gas Electric Light & Power Co. of Baltimore in the form of first and refunding mortgage bonds, amounting to $12,000,000.

Utilities Register Proposed Issues

Declaration has been filed with the Securities and Exchange Commission by the Public Service Co. of Oklahoma proposing to issue and sell $16,000,000 of 3 per cent first mortgage bonds, due in 1971, and 83,500 shares of $100 par value 5 per cent preferred stock. Funds will be applied to the retirement of outstanding issues.

Florida Power Co. has filed a declaration regarding the sale to John Hancock Mutual Life Insurance Co. of $1,000,000 first 4s, series C, due December 1, 1966, and $2,000,000 serial debenture 3⅛s, proceeds of which would be used for refunding and discharging $1,933,000 outstanding 5 per cent debentures and $600,000 promissory notes, and for the purpose of financing the business of the company.

Peoples Light & Power Co.'s declaration regarding the borrowing of $900,000 to be evidenced by promissory notes maturing semi-annually over a five-year period has been permitted to become effective.

•

Proposes Note Issue

Durham Public Service Co. has filed an application with the Securities and Exchange Commission regarding the proposed issuance of $400,000 of 2½ per cent unsecured note, due September 1, 1943, to John Hancock Mutual Life Insurance Co. to evidence a loan.

Utility Reports

	Net Income 1940	1939
*American Gas & Electric and subs.	$15,130,801	$13,358,672
*Blackstone Valley Gas & Elec.	1,043,888	1,094,899
*California-Oregon Power.	948,971†	905,573
*Columbia Gas & Electric and subs.	3,090,695	2,901,563
*Eastern Shore Public Serv.	335,054†	418,198
*Iowa Elec. Lt. & Pwr.	858,148†	959,508
*Louisville Gas & Elec. (Del.) and subs.	1,403,450†	1,401,048
*Lynn Gas & Electric	853,267	831,285
*Marion-Reserve Power	610,034†	554,657
*Montana-Dakota Utilities.	1,009,925	770,351
*Pacific Power & Light	851,957†	885,759
*Pennsylvania Water & Pwr.	2,115,501	2,173,843
*Southern Calif. Edison	12,179,771†	12,701,916
*United Corp.	9,557,142	8,482,675

* Twelve months ended December 31.
† Preliminary report.

New Issues of Electric Light and Power Securities in January

Name of Company	Amount (Par Value)	Offered to	Period	Class	Purpose	Interest Rate	Price	Per Cent Yield
Central New York Power Corp.	$5,000,000	Placed privately	24½	General mortgage bonds	Additions	3½	101	3.43
Consol. Gas, Elec. Lt. & Pwr. Co. of Baltimore	12,000,000	Public	35	First and refunding mtge. sinking bonds, series Q	Refunding	2¾	103½	2.59
Luzerne County Gas & Elec. Corp.	7,500,000	Public	25	First mortgage bonds	Refunding	3¼	104¾	2.97
Montana-Dakota Utilities Co.	7,500,000 2,500,000	Public Public	20 1–8	First mortgage bonds First mortgage serial bonds	Refunding Refunding	3½ 2½	103½ 101.88 103.39	3.26 —
Total	$34,500,000							

SPIRAKORE TRANSFORMER

REG. U.S. PAT. OFF.

Now—up to 500 KVA

YOU can now obtain the G-E Spirakore transformer in various ratings in the distribution range, and as large as 500 kva. Advantages to the designer that result from the remarkable Spirakore construction appear throughout the transformer. For example, better impulse characteristics, improved thermal characteristics, and lower exciting current, each contributing to improved operation. Also, in most ratings, smaller size and lighter weight to make handling easier.

Furthermore, manufacturing economies made possible by the Spirakore construction have enabled General Electric to make a series of price adjustments throughout the distribution-transformer range. As a result, the market levels of distribution transformers now average 15 to 20 per cent lower than in the period immediately before the introduction of the Spirakore design. General Electric, Schenectady, N. Y.

Spirakore transformers are designated TYPE HS.

GENERAL ELECTRIC

402-21

OPERATING PRACTICES

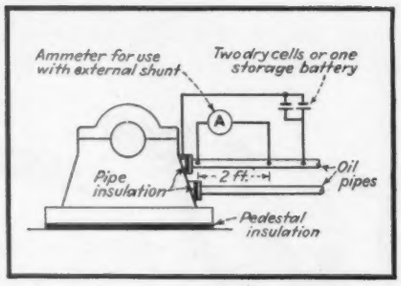
Operating Tests for Bearing Insulation

By Le ROY COFFIN
Assistant Engineer Rotating Machinery Division, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Large rotating electrical machines are frequently provided with insulation to prevent the flow of shaft currents and consequent injury to bearing surfaces. Although this insulation has been tested at the factory, it should be tested on installation and occasionally thereafter, since a metal chip or sliver may destroy the value of the insulation. Several methods for testing this insulation, while the machine is both at rest and running, are here suggested.

Insulation of this type is generally applied as follows:

1. Pedestal bearing machines usually have insulation between the pedestal and base on which it rests. Bolts and dowels connecting pedestal and base are insulated, as are oil or water pipes connected to the pedestal.
2. Bracket or housing bearing machines may have the bearing bracket insulated from the machine frame or a bearing bushing may be insulated from the bracket.



D.C. TEST for defective pipe insulation. Connects as shown. If ammeter needle moves, insulated joint is defective

3. Vertical type machines usually have thrust bearings insulated from its support.
4. Coupled machines may be insulated from each other in the coupling.

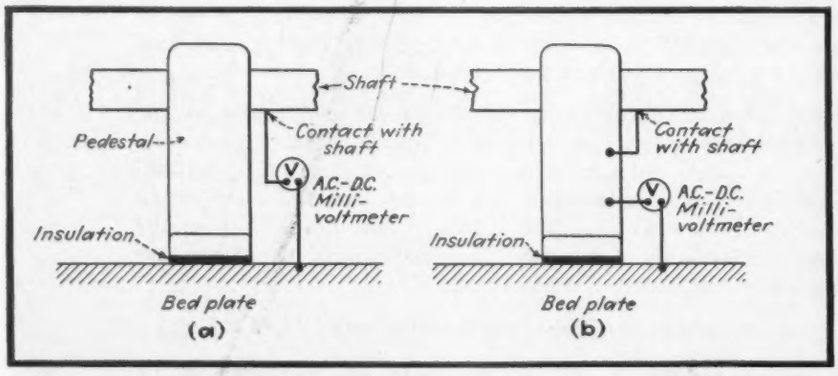
During assembly perhaps the most convenient method of making this test is to use a bell-ringing device or impress 120 volts across a light bulb and the insulated joint connected in series. In either method the shaft should be raised at one end to provide another opening in the shaft circuit. One end of the rotor may be raised before putting on the bearing cap and a thin flexible piece of fibre inserted between the shaft and lower half of the bearing. With one lead of the testing device in contact with the shaft and the other on the lower half of the bearing faulty insulation is indicated if the bell rings or the lamp lights.

Operators are frequently at a loss for a method of testing this insulation when the machine is running. A low-voltage lamp may be shunted around the insulation where shaft voltage is sufficient to light it and if the lamp glows the insulation is considered satisfactory. It is possible, however, to have a shaft voltage which is too low to light the lamp and yet large enough to produce injurious shaft currents, in which case the light would be useless.

Another running test is shown in the accompanying illustration. In (a) the milli-voltmeter measures any potential drop across both the bearing oil film and the insulation. In (b) it measures any drop across the insulation alone. This method will indicate if the insulation is faulty, but further tests may be necessary to determine just where the fault exists.

Pipe insulation may be tested for such a fault by the method shown. If current is flowing through the joint the meter will indicate a potential drop along a section of the pipe. The meter may be a milli-voltmeter or it may be an ammeter designed for use with an external shunt.

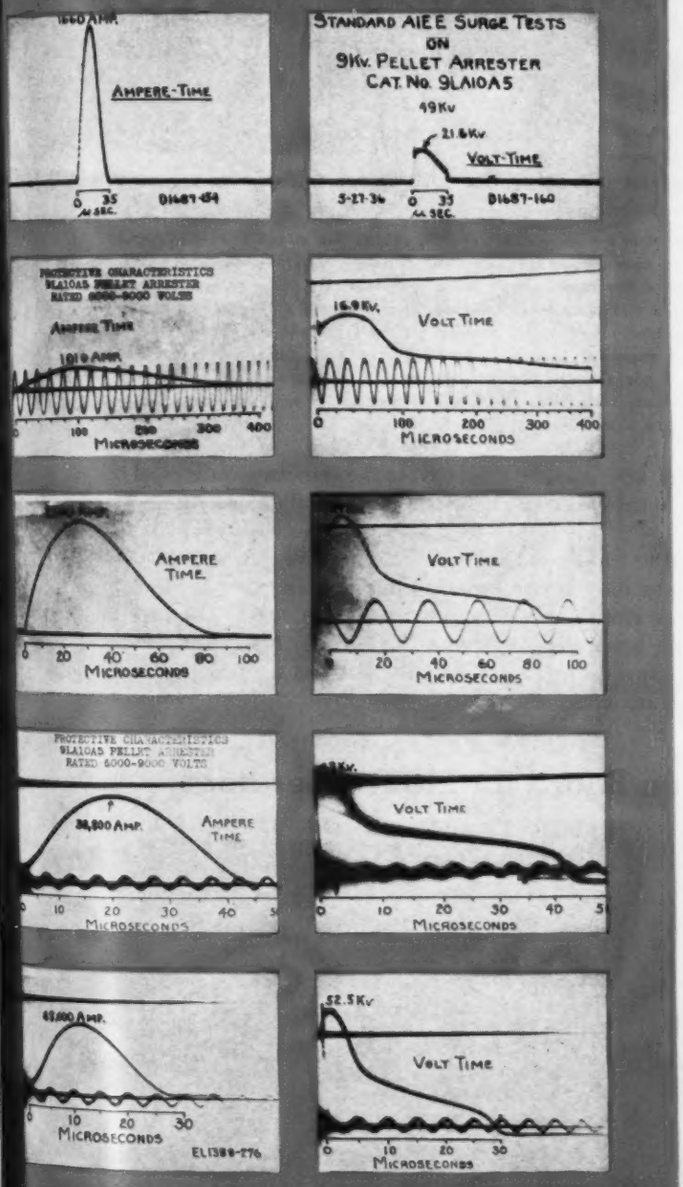
It might appear desirable to insulate the shaft circuit at two points and thus enable the operator to test insulation at will. This should not be done if it completely insulates the shaft from the ground, since accidental breakdown of insulation on the rotor winding may result in a potential on the shaft dangerous to operators.



POTENTIOMETER METHOD for testing bearing insulation of a rotating machine in operation. If reading in (a) and (b) are the same, insulation is satisfactory. If reading (b) is lower than (a) insulation is defective. Method makes use of shaft to ground potential

Why Skimp?

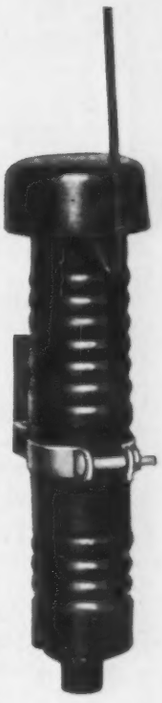
Here's EXTRA Protection Against Lightning for Your Distribution Transformers



Cathode-ray oscillograms showing impulse volt-time protection levels of 9-kv pellet arrester corresponding to various ampere-time oscillograms of low, medium, and extremely high lightning-discharge currents through the arrester

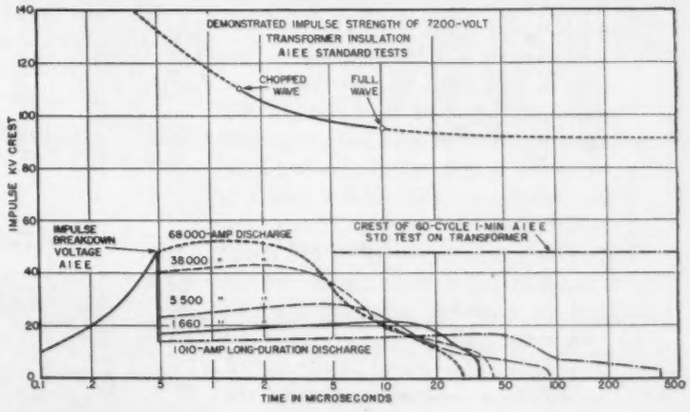
Here Is the Evidence

Take a 7200-volt case. These are performance oscillograms of a 9-kv G-E pellet arrester at low, medium, and high lightning discharge currents.



This Is What It Means

See how the protective performance shown by the oscillograms compares with the AIEE impulse test level of a 7200-volt distribution transformer. Even at extremely high discharge currents, the G-E pellet arrester holds the voltage to about one-half the transformer test level.



It's that extra margin of safety that counts

1. You avoid repeated stresses close to the transformer strength.
2. You have plenty of margin of protection, even assuming considerable depreciation of transformer insulation with years of service.
3. You get excellent protection for your *old* transformers as well as for new ones.
4. You can expect the maximum life of your transformers.

Get that extra margin of protection for your distribution system. Select pellet arresters from Bulletin GEA-2975. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

405-5-5600

Magnetic Tester for A.C.S.R. Joints

J. E. REID
Transmission Section, Electrical Engineering Department, Hydro-Electric Power Commission, Toronto

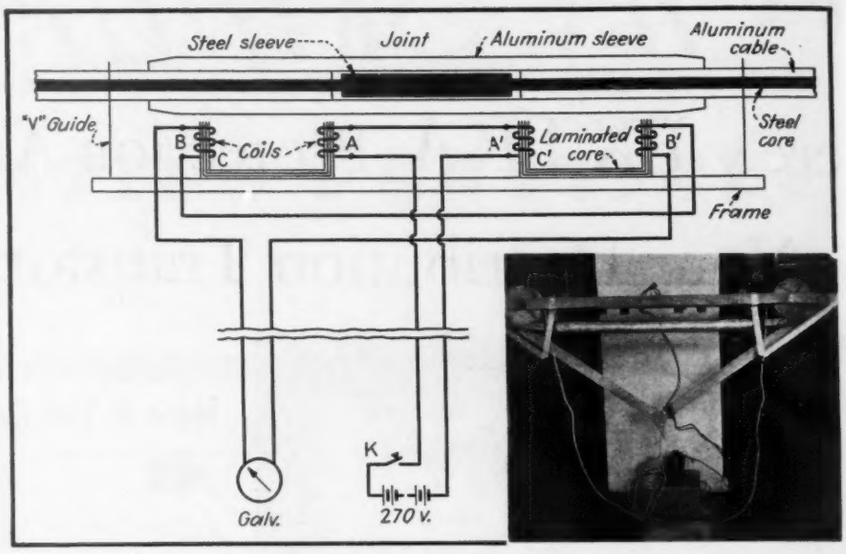
With a recently developed electromagnetic testing apparatus, joints in steel-reinforced aluminum conductor have been effectively tested in place for alignment of the steel and aluminum sleeves. An error of ½ in. in alignment within a splice of a de-energized conductor may be determined with this tester. The apparatus also serves as an incidental check on the increase in length of the compressed joints, thus checking the correct operation of the hydraulic press and dies used in making the splice.

The apparatus consists of four similar coils, mounted two each on laminated magnetic cores and suspended from an aluminum frame. Two of the coils, one on each core, are interconnected through a 270-volt battery supply. The other two are interconnected through a galvanometer. A deflection of the galvanometer when the apparatus is properly centered over the aluminum sleeve indicates misalignment of the steel sleeve beneath.

Apparatus may be applied to the joint in two ways. If the joints are not more than 35 ft. from the ground, poles may be used to raise the apparatus, which is then readily hooked over the conductor. For higher joints a trolley may be used to carry the apparatus from a tower to the joint. When the trolley is centered over the joint the magnetic equipment, which is suspended above the conductor by springs, is pulled down to the top of the joint by a rope manipulated from the ground, though the ends of the laminated cores are not allowed to touch the aluminum sleeve. In either case the apparatus, which is symmetrical, must first be properly centered over the aluminum sleeve. Carefully made "V"-guides or hooks are necessary so that the apparatus will be parallel to the joint.

After the apparatus is properly centered very little time is required to test the joint. The galvanometer is actually used as a ballistic galvanometer, the maximum throw or swing of the needle being a measure of the amount of misalignment of the joint. Either the deflection obtained on opening or closing the key may be used, although that on opening is considered preferable.

The instrument may be calibrated by making up a standard joint using the same conductor and steel sleeve, the aluminum sleeve not being necessary. The instrument is applied to the joint and shifted known amounts each way from the center. Readings of the galvanometer at these positions give the information necessary for plotting a calibration curve. A warped joint may account for an error in the reading of about ½ in. Eddy currents induced in the aluminum cable and sleeve do not affect the readings of the galvanometer.

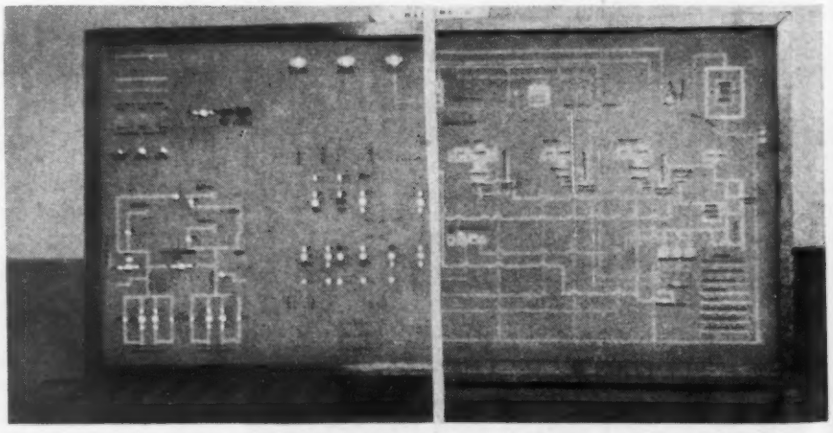


MAGNETIC TESTER determines alignment of steel and aluminum sleeves on de-energized steel-reinforced aluminum conductor

When key *K* is closed current in similar coils *A* and *A'* causes flux in two magnetic circuits, one composed of laminated core associated with coils *A* and *B* together with steel core of cable and part of steel sleeve, the other circuit being similar at the other end of joint, with a considerable air gap in the two circuits. If steel sleeve is properly centered longitudinally in aluminum sleeve then magnetic flux linking *B* and *B'* is the same and flux decay when key is opened causes equal and opposite voltages in *B* and *B'*, hence no deflection in galvonometer. If the steel sleeve is displaced a deflection will occur. Picture shows equipment with a wooden trolley for use on joints more than 35 ft. above ground; in practice, magnetic coils are usually much closer to the aluminum.

• • •

Instruction Board for Plant Operators



This composite view shows both sides of the illuminated instruction board used at the Fort Worth plant of the Texas Electric Service Company for educational purposes and to show operators how best to isolate different types of trouble. The face of the board, at the left in this view, shows a diagram of the plant electrical system as to the point where it leaves the building. Toggle switches operate small 6-volt lamps at switch positions on the diagram and permit any operating condition to be duplicated. Reverse side of the board (right) shows the mechanical system of the plant in a similar manner. The instruction board is 6½ ft. long, 6 ft. high and 3½ ft. depth. Its frosted glass panels are 3 x 6 ft.

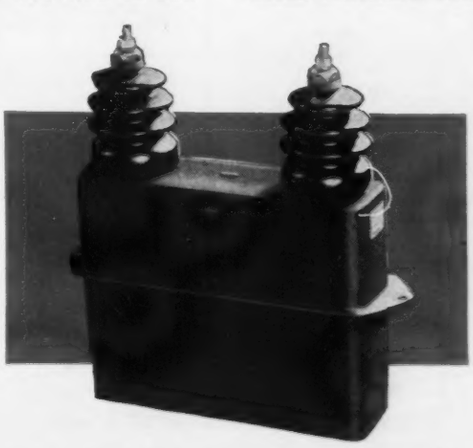
"Enlarge" Your Substations

with Pyranol Capacitors

IT'S THE QUICKEST WAY TO GAIN CAPACITY—AND THE COST IS LOW

EIGHTEEN hundred kva of substation capacity *obtained for only $15.84 per kva.* That's one electric service company's experience with G-E Pyranol capacitors. Another reports a gain of *206 kva* of substation loadability after installing *only 360 kva of Pyranol capacitors.* A third tells of using them to boost capacity in all substations *from 10 to 30 per cent.* And if your equipment is overburdened with low-power-factor loads, you can make a similar "expansion."

Pyranol capacitors are easy to install—and equally important, they're easy to relocate when loads change. They're available for service anywhere—indoors or out—in banks of any required rating. Moreover, you can get them quickly—most standard ratings are shipped right off the shelf.



In preparing for growing loads, don't overlook valuable capacity already installed. Make it available by neutralizing reactive kva—by improving power-factor with Pyranol capacitors. Your G-E representative will be glad to give you further information—including a quick estimate of the added capacity and savings possible with Pyranol capacitors.

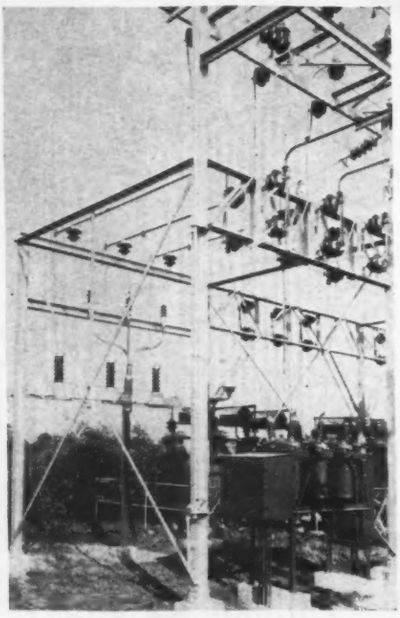
Ask for Bulletin GEA-3333, General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

407-17

Saving Material in Cable Terminal Bay

Advantages of a simple layout in tying an important 22-kv. underground cable into a bus fed from overhead circuits at a substation in the vicinity of a defense project are



SHORT CONNECTIONS between potheads and buses simplify conductor arrangement and economize material

illustrated herewith. Identification is omitted for obvious reasons, but the layout is noteworthy for its economy of material and the facility with which erection was effected.

Incoming circuits are brought into the bus at 22 kv. from a pole at the left and are provided with an oil circuit breaker in each phase, with the usual disconnects on each side of the breakers and a by-pass connection in each phase with selector switches of the disconnect type to enable the service to be kept alive from both circuits even if both line breakers are out for inspection or repairs. By adding a single structural steel bay, with but two columns at the outer end and the usual cross-bracing, only three outer horizontal members were required. The top one carries the supporting pin-type insulators for tubular bus extensions run from the main arbor to the outside of the bay, the inside ends of these buses being terminated at insulators carrying the disconnects between the bus and the breaker in the cable feed circuit. The next member carries bushings at which the phase wires connect with the cable main pothead, and the lowest member has the double function of supporting lightning arresters and the main pothead, from which a 22-kv. Simplex, three-phase, No. 2 copper conductor cable is carried downward into the ground and run to the load center.

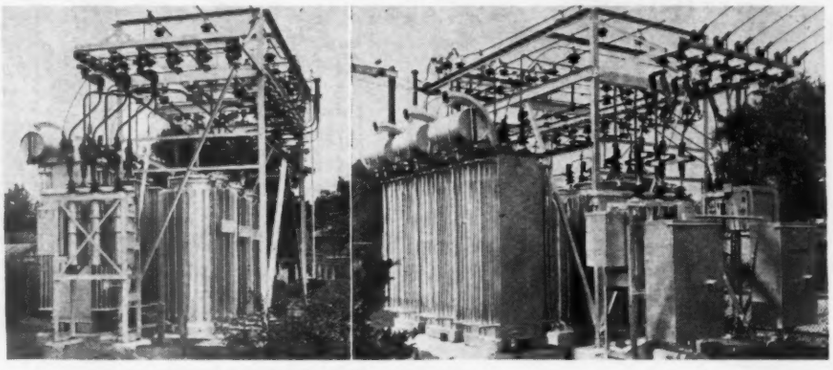
Provision for moisture drips is made by right-angled turns in the downtakes from the bus extensions, and the spacing requirements are easily met by this simple design.

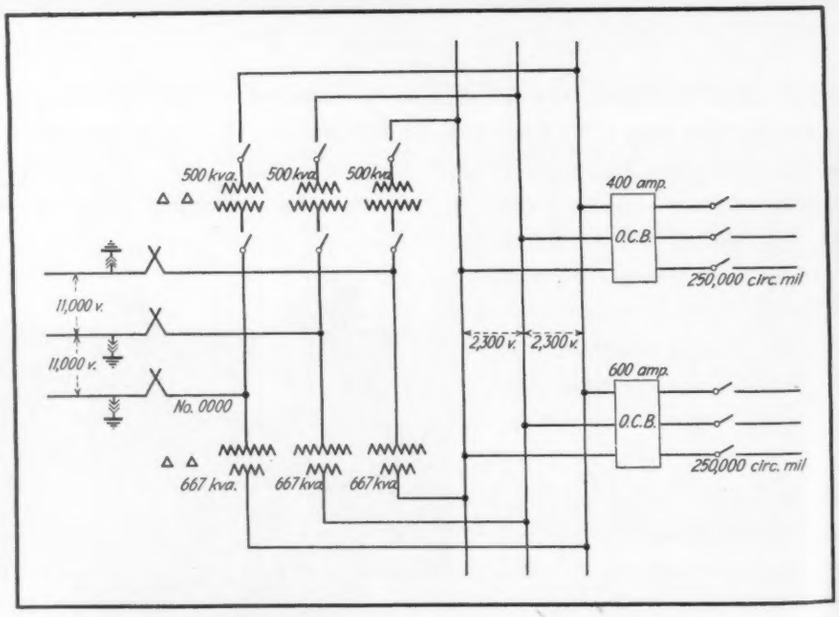
•

Unit Substation Uses Available Transformers

Three existing transformers were coupled with three more recent ones to constitute an automatic unit substation for Rocky Mount (N. C.) Public Utilities. Three General Electric 667-kva. transformers had been used to step up from the 2.4 kv. generated voltage to 11 kv. for feeding Rocky Mount mills. By 1936 these transformers had been loaded to capacity and three additional General Electric 500-kva., 11/2.4-kv. transformers were purchased to increase the capacity of the mill circuit to 3,500 kva.

Completion of a new main 11-kv. substation in 1939 adjacent to the power plant made it possible to serve the mill directly from it. Thereupon the 3,500-kva. substation was dismantled and relocated in a heavily-loaded distribution area and at the same time made automatic; revisions include an additional oil circuit breaker together with complete automatic trip and reset equipment for both breakers, set at 15 seconds, 30 seconds and one minute before locking in the out position.





RECLAIMED TRANSFORMERS incorporated in 3,500-kva. unit substation

Top, left—Serves two 2.4-kv. primary feeders with margin of capacity for additional feeders as load in the district grows.

Top, right—Two types and ratings of transformers no bar to effecting a unit substation.

Below—The three 500-kva. transformers are provided with disconnects on both sides, but none on the other bank of transformers.

DO YOU NEED POWER CABLE NOW?

HERE ARE 372 ITEMS YOU CAN GET RIGHT OFF THE SHELF

DELIVERIES today on 'most everything are becoming more and more important, and that applies of course to insulated power cable. You can save a lot of time by ordering stock items.

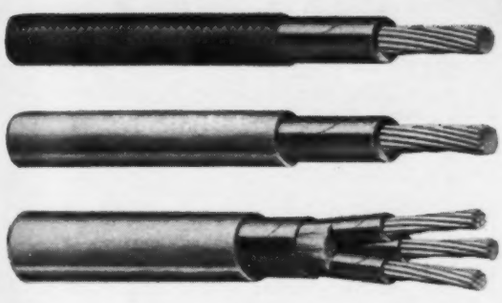
Here are four lines—selected because they have become G-E standards and are tops in their respective fields—and because we can supply some 372 different items from stock, *right off the shelf.*

There are also hundreds more—apparatus leads, switchboard wire, line wire, control cable, and others—and we'll gladly give details.

From the data shown here, you can get an idea of what are available and can judge if any of these standard items will meet your requirements. For current prices and more details, call or write the nearest G-E office or G-E distributor. Or see the new *Cable Digest,* which has application data, approximate prices, and a section, "How to Select Conductor Size," based on the 1940 N. E. Code. Ask for Bulletin GEA-3280. General Electric Company, Schenectady, New York.

SAVE TIME

1. NO. 1799 VARNISHED-CAMBRIC



A proved performer—with a 40-year outstanding service record. Excels on dielectric strength, is suited for high voltage. Cable can be operated at 85 C—on heavy currents, saves copper.

Where to use: for power feeders.

75 ITEMS IN STOCK

Single-conductor
600, 3000, and 5000 volts—braided and leaded

Three-conductor
600, 3000, and 5000 volts—leaded

2. VERSATOL* BRAIDED POWER CABLE

Insulation has a water-absorption factor of 0.010 gram per sq in.—cable needs no lead sheath. Operating temperature, 75 C—highest for rubber. Oxygen-bomb aging, 504 hours—approximates 50 years' natural life.

Where to use: for general-purpose wiring.

*REG. U. S. PAT. OFF.

20 ITEMS IN STOCK

Single-conductor
600 volts, braided
(See also tellurium parkway)

SELECT STANDARDS

"It must . . . be remembered that standard lines have become standard because they have on the whole performed best . . . Furthermore, every order for special equipment, where standard would have done, takes just so much production time away from some other order that is needed for defense. Thus, specials defeat their own purpose and help to slow up the defense program."

ELECTRICAL WORLD
Oct. 5, 1940

INSULATED CABLE

ALWAYS THE RIGHT TYPE FOR EACH JOB

3. FLAMENOL*—SELF-PROTECTED

An outstanding G-E synthetic-insulated cable. Needs no protective finish. Resists oil, acids, alkalies, moisture, and flame. Operating temperature, 60 C.

Where to use: for all low-voltage jobs where wiring must meet extraordinary conditions.

*REG. U. S. PAT. OFF

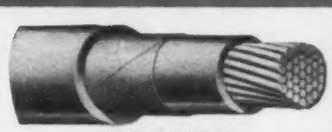
150 ITEMS IN STOCK

Single-conductor
600 volts, 12 colors. More sizes of black are carried in stock than of any other color.

4. TELLURIUM

With jacket of 60% new rubber, cured with tellurium. TOUGH—will last for years

PORTABLE
For all types of portable electric equipment



PARKWAY
For direct burial in ground, for use in ducts and in other places

76 ITEMS IN STOCK
Superflexible arc-welding cable
600 volts—single-, 2-, 3-, and 4-conductor
2500 volts and above—3-conductor, Type G

51 ITEMS IN STOCK
With 30% rubber or Versatol insulation
600 volts—single-, 2-, and 3-conductor
2500 and 5000 volts, single-conductor
5000 volts, 3-conductor

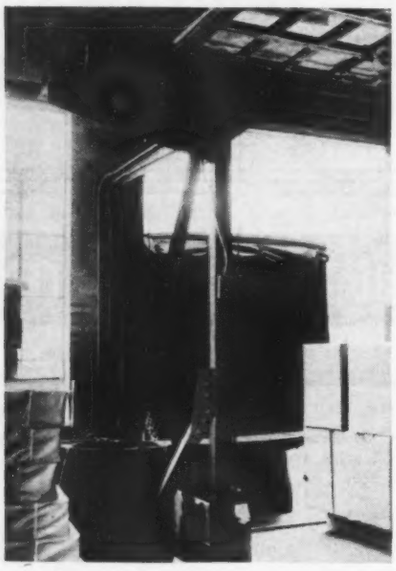
GENERAL ELECTRIC

502-1

INDUSTRIAL ENGINEERING

Bracket Mounting for Elevator Motor

A Massachusetts industrial plant equipped with individual motor drives uses a freight elevator which handles paper and envelope stock between the shipping room floor level and outgoing truck tailboards. To insure a simple and inexpensive layout, the motor was mounted on a structural steel bracket which carries it in outboard fashion at the top of the elevator framing, with direct coupling to the elevator shaft and wire rope pulleys which raise and lower the platform.



OUTBOARD-SUPPORTED MOTOR drives industrial elevator with maximum space economy

Across-the-line starting was provided, with push-button control at the front of the elevator frame, and conduit wiring to safeguard the service and operator. The motor operates at one speed normally. Its design (United States Electrical) provides for complete metal-clad protection, and the direct drive used saves space in a section of the plant subject to the movement of material in bulk at a rapid pace.

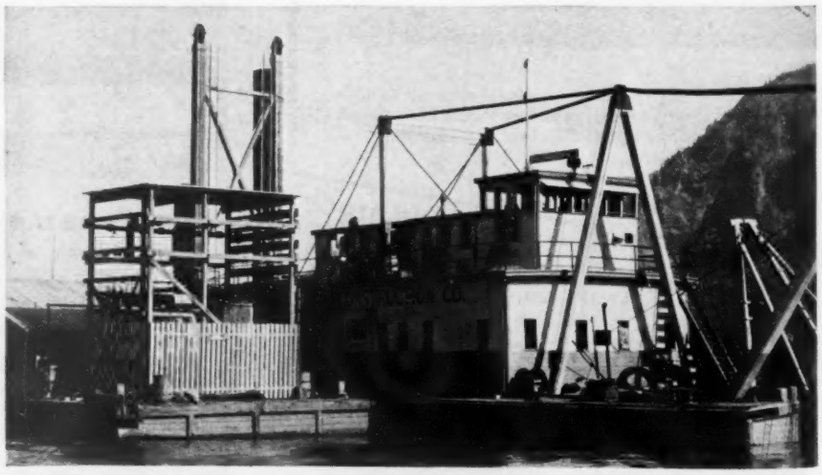
•

Line in River Serves Columbia Dredge

An overhead 11-kv. line built on piles in the water is the distinctive feature of power supply to the dredge used by the General Construction Company in its contract for 2,600,000 cu.yd. of hydraulic fill for relocation of the Columbia River Highway between Portland, Ore., and Bonneville Dam. The dredge, its suction pump driven by a 2,500-hp. General Electric motor, will be working over about 8 miles of river channel. Therefore a flexible method of getting power to it had to be devised.

A temporary substation was erected by the serving utility, the Northwestern Electric Company, to take energy from a 66-kv. line conveniently near by. An 11-kv. line was then constructed to the river bank and carried across a narrow channel to a sandbar on piling, thence across the bar and into the main channel. Here it connects with a line carried on piling driven in the river bed and roughly paralleling the course to be followed by the dredge. The piles are approximately 500 ft. apart and are single except at angles, where dolphins are required. The water in which they are driven ranges from two to 30 ft. in depth.

From the pile-supported supply line current is delivered by a 3,000-ft. submarine cable to another substation on a barge made fast to the dredge. This cable contains three No. 4/0 conductors, rubber insulated and surrounded with tarred jute, over which steel armor wires are laid spirally. For connection to the supply line the cable conductors are fanned out and the fork waterproofed. The cable end is then hoisted up on the last pile and connection made direct to the line. There is no switching equipment at this point and no special anchorage of the cable more than that required



DREDGE and barge substation

G-E *Offers*

a Complete Line of
PYRANOL
Current Transformers

FROM 15 KV TO 161 KV
and higher if required

•

WITH THESE CHARACTERISTICS:
PYRANOL FOR SAFETY
ACCURACY 1/4X, 1/4Y, 1/4Z
SMALL SIZE — LIGHT WEIGHT
INSULATION TO MEET ASA STANDARDS

For further information write to the nearest G-E Office, or to General Electric Company, Schenectady, N. Y.

TYPE KF-326
69 KV

GENERAL ELECTRIC

to hold its weight was necessary.

The length of the cable enables the dredge to work a distance of about 2,000 ft. at one setting. When that is finished the cable is disconnected from the line, moved along and reconnected.

The dredge makes two passes to secure the necessary channel width, traveling about 500 ft. and paying out the submarine cable from a large reel on the transformer barge. Then it returns to the starting point, reeling up the cable with power supplied by a small gasoline motor, through a chain drive to gears on the end of the reel support.

The transformers, of 3,000 kva. total capacity, located on the barge, are inclosed in a wooden structure at one end of the barge. In a house adjoining is the cable reel and winding engine. The main transformers reduce the voltage from 11,000 to 2,400, at which pressure it is applied direct to the main dredge motor and to a 200-hp. motor which operates the "cutter" for loosening material at the suction intake; 50-kva. auxiliary transformer equipment furnishes 110-volt current for lights and the operation of small motors used on the swing drums, in machine shop, etc.

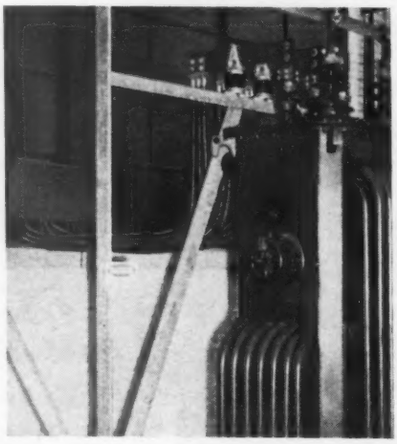
•

Weatherproof Head for Service Cables

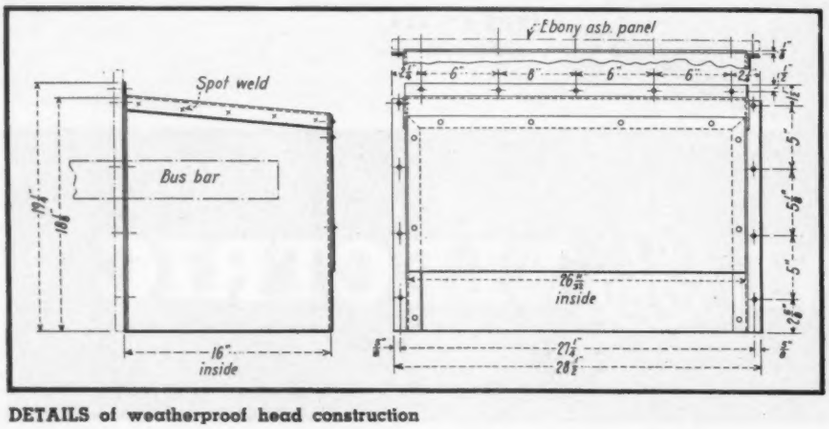
A weatherproof service head of rather unusual design has been employed at the new factory building of the Square D Company, Milwaukee, to connect lighting and power buses in the outdoor factory substation with stub buses projecting through the factory wall and leading to the main switchboard.

Stub buses extending from just outside the building wall to the main switchboard pass through slotted ebony asbestos panels set in the window frames. Bus ends projecting outdoors are covered with fuller board and taped and the whole inclosed in an open bottom metallic hood to keep out the weather. Connection from buses in this service head to the power and lighting buses in the substation is by means of flexible cable, as shown in the accompanying illustration. A total of nine 500,000-circ. mil cables are used for the power circuit and two sets of three 750,000-circ.mil cables for the two separate single-phase lighting buses.

Factory power is derived from a three-phase, 240-volt, three-wire grounded system supplied by a 450-kva., 13,200/240-volt, three-phase transformer. Lighting service is supplied from two separate 200-kva., single-phase transformers tapping different phases of the incoming 13.2-kv. line which steps voltage down to 240/120 volts for the separate three-wire systems in the plant.

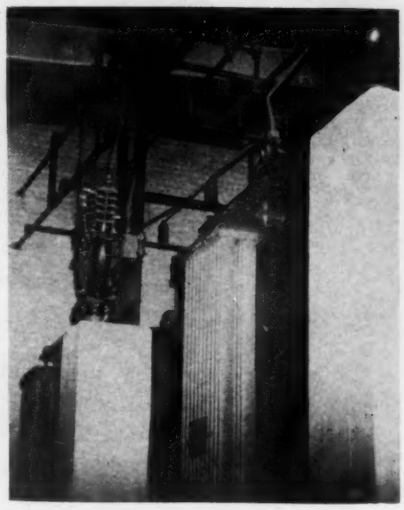


CLOSE-UP of cables from secondary of 450-kva., three-phase power transformer entering metal-inclosed weatherproof service head



DETAILS of weatherproof head construction

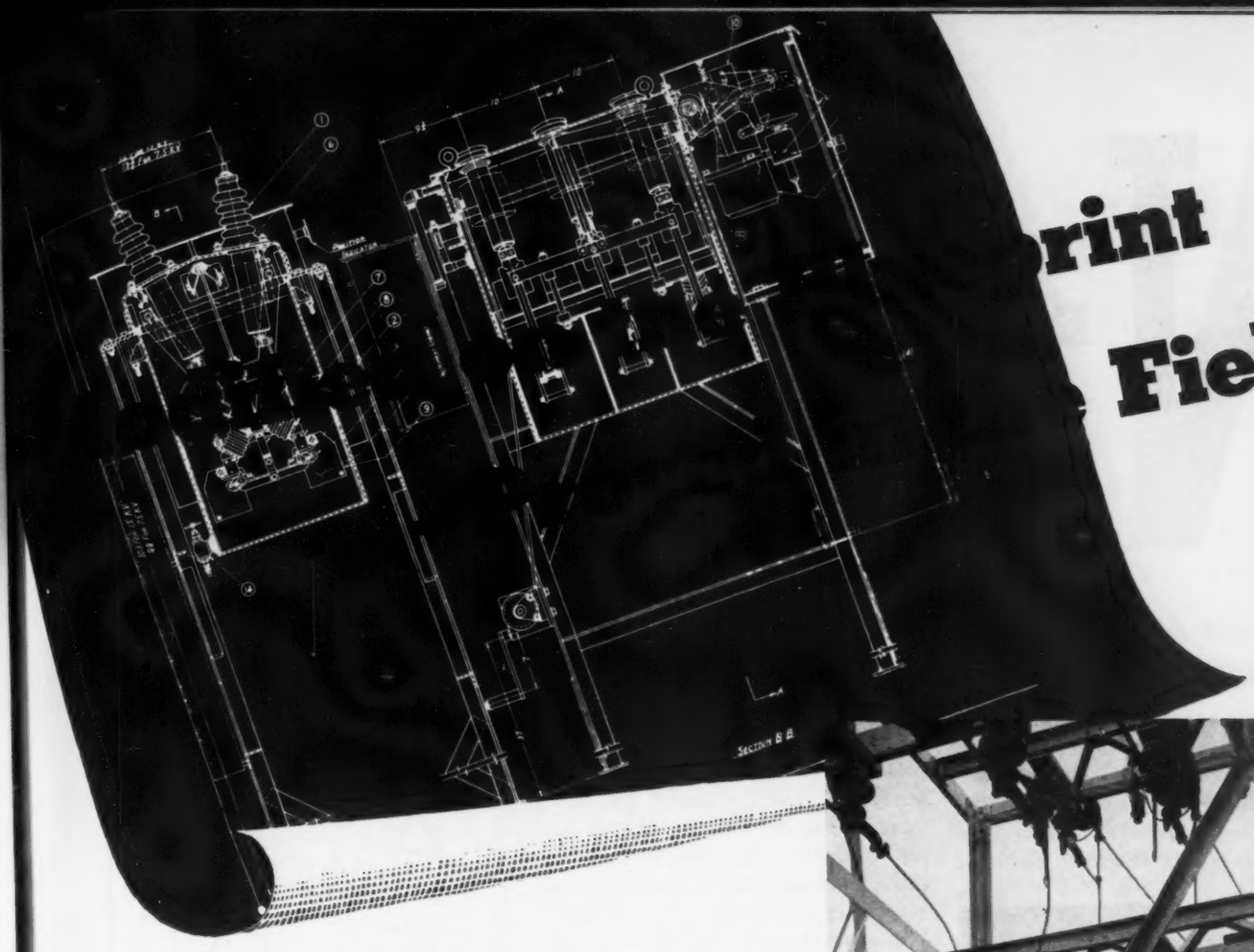
Concrete Envelopes Shield Primary Cables



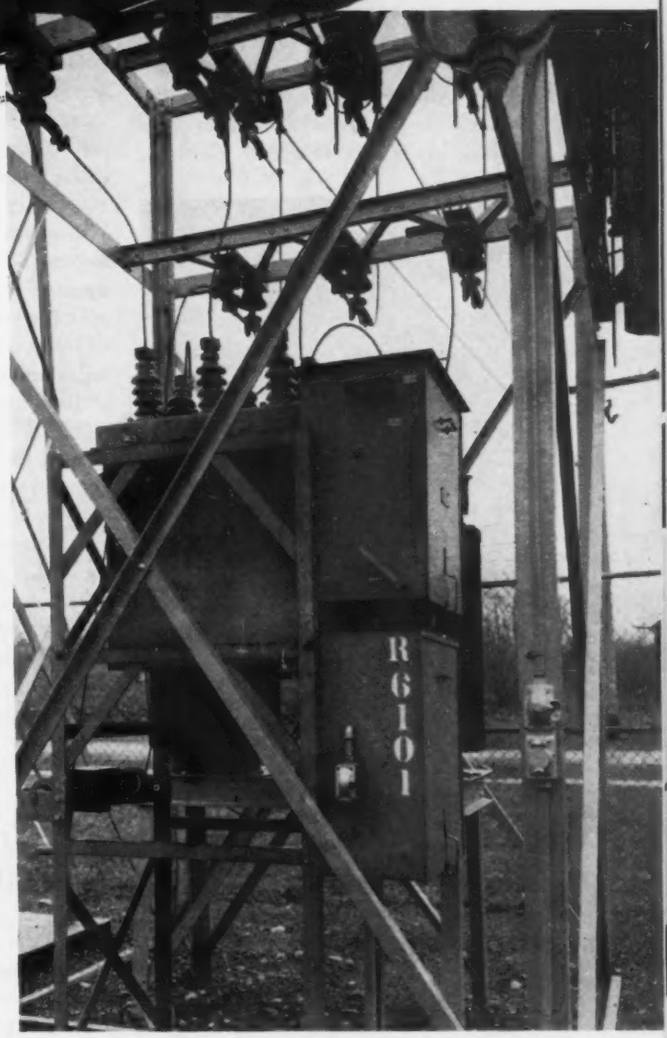
In a 2,000-kva. industrial substation supplied with purchased energy at 22 kv., with the transformers located inside the plant, special attention was given in the layout design to safeguarding all high-tension equipment against mechanical injury or casual contact from operators.

Space limitations made it necessary to bring the two cables feeding the primary bus into the substation in front of the transformers, and these were safeguarded by concrete envelopes carried from the floor to the approximate tank top level, mounting three-phase potheads at the top of the envelope and making a short and direct connection to disconnecting switch terminals immediately above. This minimized the amount of open wiring on the high side of the transformers. Pipe buses carried on bus insulators above the transformers enabled short connections to be made to the transformer bushings, utilizing a high ceiling for securing ample spacing and separation of live conductors from grounded supports as shown.

On the low voltage side of the transformers the 550-volt service to motors is provided by flat copper bars making a short run through the substation wall barrier to a local distribution switchboard, the layout minimizing the amount of copper required as a result of the transformer set-up. Continuous flow of energy and liberal spacing facilitate the safe handling of all work on the premises, and the compactness of the wiring reduced structural costs materially.



rint Field



You get the benefit of improvements suggested by other operating engineers . . . and proved performance as well . . . when you specify Roller-Smith outdoor breakers.

Because the design was checked in the blueprint stage—before a single breaker had been built—it was possible to incorporate suggestions that adapted the breakers more specifically to operating requirements. The result—acceptance by utilities in almost every part of the country.

And, since many of these breakers have been called upon to open short circuits under actual operating conditions, the design . . . and construction . . . have been fully proved.

Check the features of our 50,000 KVA, 7500 volt breaker, for example, and see for yourself the quality that has been built into this equipment:

- ★ Inverted A frame construction permits mounting of wound-primary or bushing type current transformers.
- ★ Magnetic blowout coils and barriers aid in arc extinction.
- ★ Inverted main and arcing contacts increase contact pressure on short circuits until moving arcing contacts reach point in stroke where separation is intended to occur.
- ★ Stationary main contacts are of the full-floating finger type with each pair backed up by springs in compression.

Roller-Smith outdoor oil circuit breakers are available in interrupting capacities of 50,000, 100,000 and 250,000 KVA. Get complete information today.

Electrical Measuring and Protective Apparatus

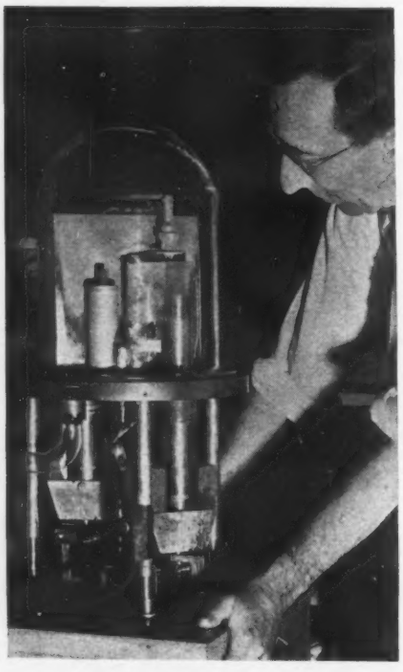
ROLLER-SMITH COMPANY BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

NEW ENGINEERING IDEAS

Magnets Aid Coating in Vacuum

To operate a disk-moving mechanism with a vacuum chamber, General Electric research scientists are using "Alnico" magnets. One of the magnets is revolved around a protruding brass tube sealed to the base



"GEARED" MAGNETS solve problem of coating aluminum disks for photo-electric cells with vaporized selenium in vacuum chamber

of the vacuum chamber. Within the tube is another Alnico magnet attached to the mechanism. As the outside magnet is revolved the other one within the vacuum-sealed chamber also rotates. Thus, without any shaft extending from the vacuum chamber, it is possible to control the mechanism.

The device was built in the G.E. research laboratory under the direction of Dr. C. W. Hewlett, for use in coating aluminum disks, used in photo-electric cells, with vaporized selenium. Each disk must be treated separately, and the use of the Alnico "gears" has made it possible to load 100 disks in the vacuum chamber simultaneously and to treat them consecutively in the small vapor chamber in the vacuum jar. One set of "gears" raises the disks one at a time, whereupon a second set of "gears" operates the mechanism which transports the single disks to the vapor chamber, holds them there the specified length of time and then removes them to the stack of completed disks.

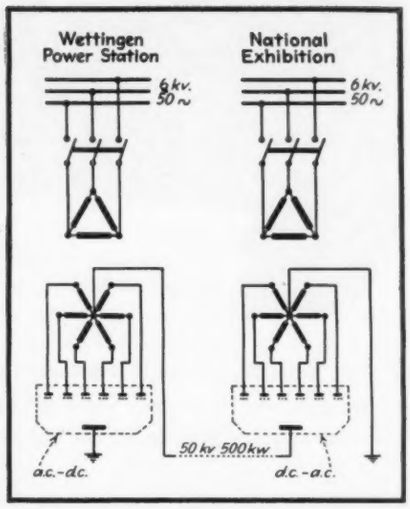
A high vacuum is used, since in air the selenium would be oxidized. In a vacuum the vaporizing temperature is lowered decidedly; moreover, vaporization in a vacuum gives the operator a control in directing the path of the vapor particles. In addition to vaporizing selenium the equipment is also applicable to vaporizing and depositing any other materials.

•

D. C. Transmission at 50,000 Volts

With the advent of high-power mercury-arc rectifiers, says the *Engineer* (British), attention has been directed to constant voltage d.c. transmission. An experimental equipment built according to this system with 50-kv. rectifiers was shown by Brown Boveri & Company at the Swiss national exhibition.

Although a pressure of 50 kv. is not high enough for the transmission of large quantities of power over long



POWER GENERATION and distribution by a.c., transmission only by d.c.

distances, the experimental plant marks an interesting development. The a.c. current is converted into d.c. on the site of power generation and at the end of the transmission line it is converted again into three-phase current for power distribution. Voltage regulation at the receiving end is obtained by on-load tap-changing switches on the transformers and by grid control of the rectifiers. D.c. is used only for power transmission.

A load of 500 kw. was transmitted at 50 kv. from the Wettingen power station, near Baden, to the exhibition in Zurich over a distance of 30 km. The a.c.-d.c. rectifier set in the Wettingen power house was connected to the generator busbars through circuit breakers and disconnecting switches. This set converted the three-phase power at 6 kv. into d.c. at 50 kv. for direct transmission to Zurich. The transmission line used was the insulated earth conductor of the existing 50-kv., three-phase transmission

line which changed over to a cable in the Zurich area and then became a single-pole overhead line again in the last section before the exhibition. High-voltage d.c. was there converted back to three-phase current at 6 kv. and delivered to the distribution system of the Zurich electricity works. This conversion took place in a d.c.-a.c. rectifier set in the exhibition substation. The converter unit was connected to the 6-kv. busbars of the substation through an air-blast high-speed circuit breaker and a compressed air-operated three-pole disconnecting switch. The earth served as a return earth electrode for one of the rectifier sets and the rails of the tramway system in Zurich for the other earth connection.

Both rectifier sets were of the same design and, apart from the control circuits, had simple connections. Each unit was comprised of the rectifier with its accessories, a main transformer and a breaker for the a.c. side, the breaker having primary current and thermal relays to protect the set from abnormally high overloads. There was an earthed switchboard panel to accommodate various service switches and measuring instruments and behind it was a highly insulated panel containing control apparatus.

When putting the plant into operation the air-blast high-speed circuit breaker of the d.c.-a.c. rectifier in the substation is closed and by closing the breakers at the other end the a.c.-d.c. rectifier is put under voltage which is raised by grid control until the current attains the desired value. A remote-control device also enables the latter rectifier to be controlled from the switchboard panel in the substation. On account of the short distance covered, short circuits on the transmission line are cleared at the sending end by the immediate action of grid control.

•

Semi-Stop Joint for "Oilostatic" Cable

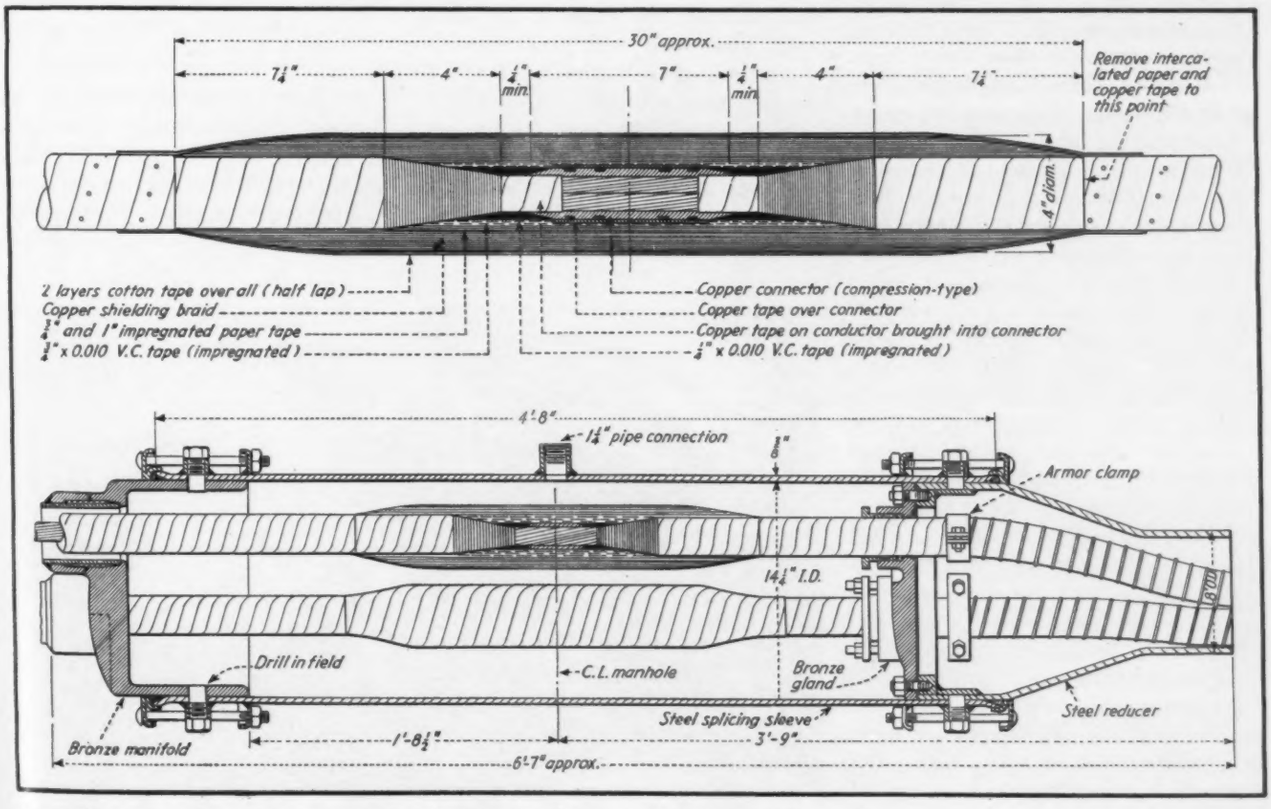
By C. E. BENNETT
Manager Oilostatic Department,
The Okonite Company, Passaic, N. J.

A new type of high-voltage cable joint being used for "Oilostatic" cable installations is made with mechanical sleeves rather than sweated connectors, heat from which might impair the cable insulation. The complete joint involves a trifurcating joint plus a semi-stop joint to isolate the sections, a departure from older designs in that the three conductors terminate in a bulkhead. (See page 40 this issue.)

After these conductors are spliced in the joint they leave as three single-conductor, single-phase leads in copper pipes which connect with the terminals of the system. This method permits the oil supply to be fed separately to the riser sections and to the main body of oil in the main line pipe.

In making the splice a solid copper connector bored out to the required clearance is installed over the conductors. The radial rings are compressed into the sleeve by the use of a "Temple" gun which is actuated by the use of a 0.45-caliber blank cartridge. Four radial rings compress the connector tightly around the stranded conductor, but in order to increase the mechanical strength of the joint a steel pin is driven in each half of the connector by the same method.

Any imperfections or valleys left by shooting the joint are covered over with copper tape so as to have a smooth uniform layer of metal next to the insulation. Tests on this joint show that it can withstand more than 22,000 lb. direct pull on the conductors without separating — about double that found in soldered joints.



TERMINATING semi-stop joint (bottom) for "Oilostatic" cable is insulated for 132 kv. and houses three 1,250,000-circ.mil spliced conductors (top)

LOAD BUILDING

Electric Heating Supplants Steam

The National Acme Company of Cleveland, manufacturer of a variety of machine products made of brass, steel and other materials, saved itself considerable expense through the application of electric heating devices to its hardening, pickling and drying processes. These processes had previously been supplied heat through a large boiler plant maintained by the company. Operation of this boiler plant through the summer months, when heat was not required for general heating purposes, entailed considerable expense and made the cost of some of the processes rather high.

A survey made of the plant showed that the steam boiler was necessary for supplying heat to only four locations in the processes. A comparative study proved that electric heat would not only do the job efficiently but also eliminate the necessity of maintaining operation of the steam boiler throughout the summer months. General Electric heating units were applied to all the processes.

In its hardening room the National Acme Company has a large cleaning tank and an oil quench tank in which steam was utilized during the winter months for heating. It was found that about 15 kw. of immersion type heaters would supply the heat necessary for this operation.

After leaving the hardening room the parts go into another room, where the manufacturer has a pickling tank for removing scale from the steel parts, as well as other tanks for cleaning and coloring the brass parts. The latter operation is done in a group of four tanks, the first containing soda solution, the third containing an acid solution and the two others being for rinsing purposes. The brass parts are first washed in the soda solution, then rinsed, then dipped in the acid solution to remove stains, then rinsed and dried. All of these tanks, of course, require heat, which is now supplied by immersion heaters totaling 25-kw. capacity. Because it was not necessary to regulate the temperature very closely in these operations, no automatic controls were required.

After the parts have been through this cleaning process they are put into the dryer. Here also the changeover from steam to electric heat proved easy of solution. A small tank was lined with strip heaters. From this tank a pipeline leads to another tank equipped with a motor-driven centrifugal dryer. As the machine rotates, a blast of hot air from the strip heaters is blown over the parts with entirely satisfactory results. Five kilowatts in strip heaters were found sufficient to give all the heat required in this operation.

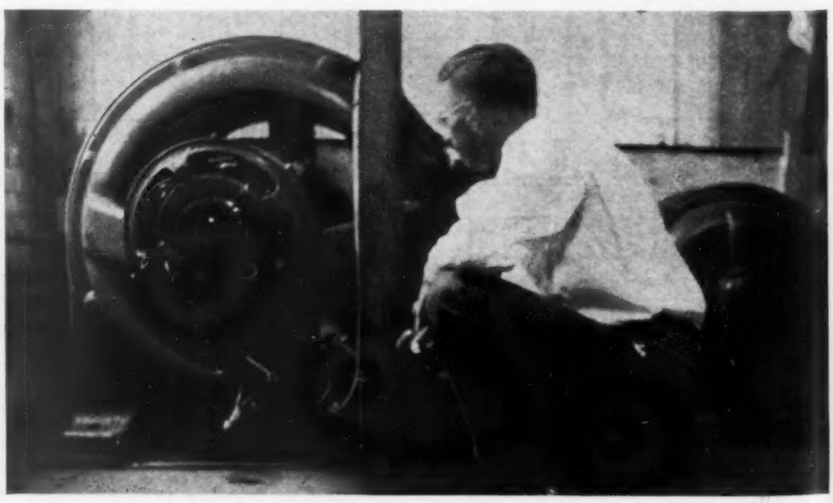
There were only two other locations in the plant where steam was required for heating during the summer period and these two were fairly easy of solution. In the laboratory, where a hot water tank was required for various uses, a 2-kw. heater was supplied. In the other location, the steam tables in the cafeteria, two 5-kw. heaters were installed.

•

Spot Welding Peaks Reduced by M-G Set

By L. M. DURYEE
Industrial Power Engineer, Connecticut Light & Power Company, Waterbury

A novel method employed by the Hayden Manufacturing Company, Bristol, for smoothing out the high, intermittent peaks created by spot welders consists of a motor-generator set with a 20-hp., 240-volt a.c.



SPOT-WELDING PEAKS are smoothed out by use of 20-hp./100-hp. motor-generator set employed by customer of Connecticut Light & Power Company

Coordination—Stamina—Balance

Certified★ FLEUR-O-LIERS

When fluorescent lighting is installed on your lines, here is an important point to remember

● Back of the superlative performance of every Certified★ FLEUR-O-LIER stands the *certified* auxiliary equipment —ballasts and starters, that control its operation.

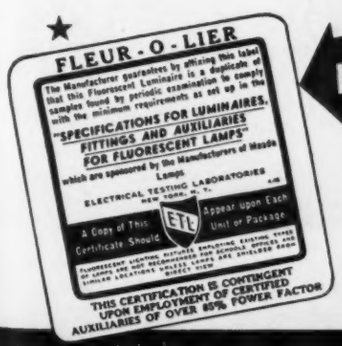
Among the 50 exacting specifications governing the manufacture of FLEUR-O-LIERS are 7 for the performance of auxiliaries which protect the user as to:

SAFETY • WATTAGE LOSS • OVERALL POWER FACTOR • NOISE RADIO INTERFERENCE • STARTER LIFE • GENERAL OPERATION

Every piece of auxiliary equipment must function efficiently with the fluorescent lamps for which it is designed, thus assuring the user of balanced, coordinated operation.

It pays to specify and buy FLEUR-O-LIER lighting equipment because it means *Certified* equipment, produced by manufacturers who are systematically supplied with the most up-to-date information on fluorescent lighting.

Write today for the interesting and factual new FLEUR-O-LIER booklet—"50 Standards for Satisfaction." FLEUR-O-LIER MANUFACTURERS, 2126 Keith Bldg., Cleveland, O.


★
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
ETL
A Copy of This Certificate Should Appear upon Each Unit or Package
THIS CERTIFICATION IS CONTINGENT UPON EMPLOYMENT OF CERTIFIED AUXILIARIES OF OVER 85% POWER FACTOR

Look for this Label

It is your protection. *Electrical Testing Laboratories* certify *that FLEUR-O-LIERS have met with 5 specifications for Lighting Effectiveness—6 for Electrical Safety—18 for Mechanical Soundness—14 for Electrical Excellence—7 for Auxiliary Performance . . . as set up by MAZDA Lamp Manufacturers. All Certified★ FLEUR-O-LIERS must be equipped with auxiliaries (ballasts and starters) certified by E. T. L.*

Measuring temperatures attained in various parts of a FLEUR-O-LIER when one or several lamps have failed. Thermocouples attached to the ballast, compensator, etc., measure the rises in temperature.

Life test of fluorescent lamp starters. The starters are wired to one cathode of each of two lamps, equivalent to failed lamp conditions, and operated continuously until failure, when they are opened for examination.

Distribution photometry. The light output in all directions around a plane and at several points of rotation about a center axis, is measured by means of a photoelectric cell.

FLEUR-O-LIER *Manufacturers*

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

Appliance Bargain Day — Sales Summary

SOUTH BEND

23 Electrical Dealers sold 402 appliances, as follows:

Ranges	53	Water systems	1	Sewing machines	6
Water heaters	5	Sweepers	44	Roasters	1
Refrigerators	25	Air Condit.	1	Corn poppers	20
Radios	96	Coffee makers	11	Misc. Includes hot pads, record players, a Mixmaster, clocks, etc.	51
Toasters	27	Flat irons	13		
Washers	30	Waffle irons	10		
Ironers	3	I.E.S. lamps	2		

Total amount of retail sales $22,351.32

ELKHART

17 Electrical Dealers sold 221 appliances, as follows:

Ranges	19	Toasters	26	Electric ovens	1
Water heaters	1	Irons	7	Clocks	1
Refrigerators	10	Food mixers	4	Sandwich grills	3
Radios	29	Electric drills	1	Heating pads	25
Sweepers	9	I.E.S. lamps	39	Waffle irons	17
Washers	15	Percolators	5	Coffee makers	1
Sewing machines	1	Razors	2	Roasters	1
Stokers	1	Ironers	1		

Total amount of retail sales $7,350.67

motor and a 100-hp., 240-volt a.c. generator. The welding transformers receive their energy from the large generator, which imparts its kinetic energy to the welders without straining the 20-hp. motor which drives it.

Two welders, totaling 175 kva., are interlocked to assure proper staggering of the actual welding load so that the largest welding machine the generator must supply is 100 kva. The flywheel effect of the generator takes the "bumps" of the welding current peaks. A fairly smooth load curve results on the 20-hp. motor, which has a good power factor because it operates close to full load at all times.

•

"Dollar Day" Builds Dealer Good Will

An astute adaptation of the established "Dollar Day" idea to the needs of appliance merchandising, introduced in the territory of the Indiana & Michigan Electric Company, South Bend, two years ago in the form of a one-day fall appliance clearance sale, has brought remarkable returns in dollar volume and new revenue to both the co-operating electrical dealers and the utility.

This one-day bargain sale has given co-operating electrical dealers and distributors a welcome opportunity to clean up appliance stocks preparatory to the main buying season and brought the utility substantial new revenue at negligible cost. During the sale a considerable volume of discontinued appliances were disposed of at concession prices, in addition to large quantities of current models sold with little or no mark-down. This was made possible by the co-operation of distributors who worked out combination offers especially for this sale and which the dealers passed on to the public.

Last year in South Bend alone the Electric Appliance Bargain Day, held on November 10, resulted in the sale of 402 appliances valued at $22,351.32 by 23 co-operating dealers, while in Elkhart on the same day 17 dealers sold 221 appliances valued at $7,350.

Some dealers did as much as $2,000 to $5,000 worth of business during the sale. Both South Bend and Elkhart had one dealer who sold a hundred small appliances. While these dealers did not gross as much as some range and refrigerator dealers, they were even better pleased with the day's results. One radio dealer in South Bend who was looking for a sale feature brought out all the old radios which had been turned in against new sets for $5 to $10 and was able to dispose of the entire lot during the day.

Success of the one-day sale can perhaps be traced to three factors:

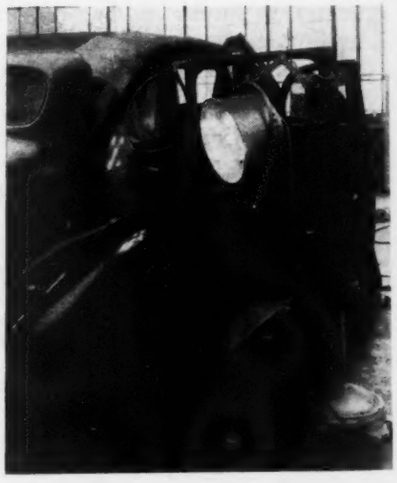
1. Build-up of local newspaper advertising on the three days preceding the sale, which was held on a Friday. Tuesday's paper, for example, carried a half-page advertisement by distributors wherein they stated that the bargains to be offered Friday were genuine. A similar advertisement Wednesday, signed by all dealers, made the same statement, and Thursday the utility also approved the sale. Also, in Thursday's paper, merchandise advertisements of individual dealers headlined bargains for the Friday sale.
2. Support given by distributors in supplying dealers with special prices and combination offers on certain appliances which they wished to move.
3. Ample space used by dealers in advertising their bargains.

In organizing the sale the procedure followed by the Indiana & Michigan Electric Company was first to call the distributors together beforehand in order to give them time to contact factories for special merchandise combinations to be featured. Somewhat later the matter was discussed with co-operating dealers in a regular monthly meeting. Newspaper representatives were present at both distributors' and dealers' meetings and these advertising men did much of the work of organizing the sale. The utility incurred little expense in connection with the organization and promotion of the sale outside of the cost of the advertising space that was run the day before the sale. However, the success of the sale was such that it is planned to extend it to include three major communities in the company's territory.

•

Infra-Red Unit Aids Auto Painting

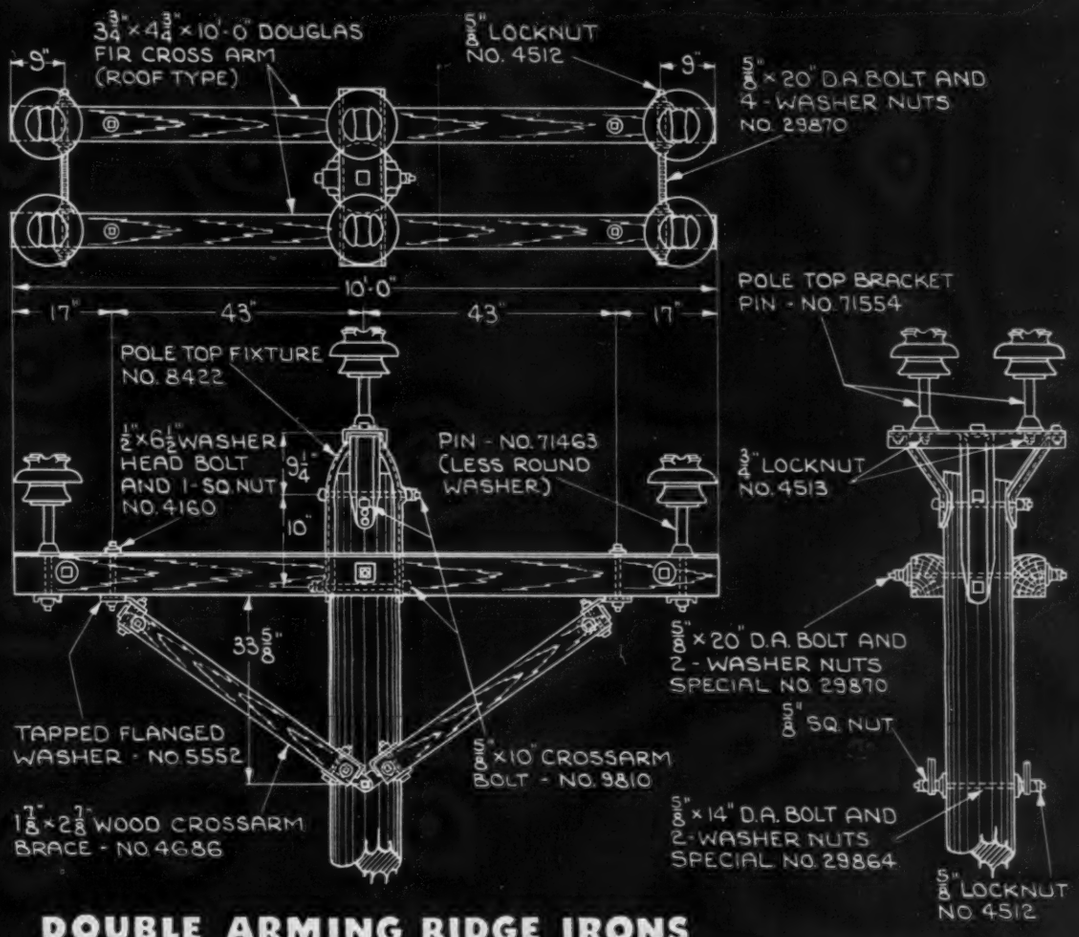
Use of a small, portable infra-red dryer, for which reflector and standard cost only about $25, has enabled a San Francisco auto painter to eliminate the spoilage from graying which often occurred on foggy, humid days and has permitted fast, rush work.



LIGHT, PORTABLE infra-red cluster unit used for spot drying on repaint jobs at auto plant in San Francisco

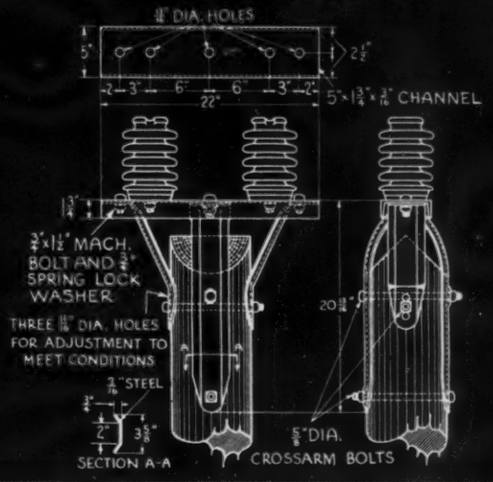
The plant which made the installation is Hanni & Girerd, San Francisco. They use a unit carrying five 260-watt infra-red lamps which plugs into a 110-120-volt circuit. After part of an automobile has been sprayed solvents are allowed to evaporate and the unit is then placed about 10 to 18 in. from the work. Drawing 1,300 watts, it is in use on an average of two hours a day.

TRANSMISSION STRUCTURES


3/4" × 4 3/4" × 10'-0" DOUGLAS FIR CROSS ARM (ROOF TYPE)
5/8" LOCKNUT NO. 4512
9"
9"
5/8" × 20" D.A. BOLT AND 4 - WASHER NUTS NO. 29870
10'-0"
17"
43"
43"
17"
POLE TOP BRACKET PIN - NO. 71554
POLE TOP FIXTURE NO. 8422
1/2" × 6 1/2" WASHER HEAD BOLT AND 1 - SQ. NUT NO. 4160
9 1/4"
10"
PIN - NO. 71463 (LESS ROUND WASHER)
3/4" LOCKNUT NO. 4513
33 5/8"
5/8" × 20" D.A. BOLT AND 2 - WASHER NUTS SPECIAL NO. 29870
5/8" SQ. NUT
TAPPED FLANGED WASHER - NO. 5552
5/8" × 10" CROSSARM BOLT - NO. 9810
7/8" × 2 7/8" WOOD CROSSARM BRACE - NO. 4686
5/8" × 14" D.A. BOLT AND 2 - WASHER NUTS SPECIAL NO. 29864
5/8" LOCKNUT NO. 4512

DOUBLE ARMING RIDGE IRONS

HOT GALVANIZED



Sept.
I agree with
K.H. use these
specifications on
the Valley Line
proposal
L. Harlie

DOUBLE ARMING TYPE RIDGE IRONS—FOR POST OR PIN INSULATORS

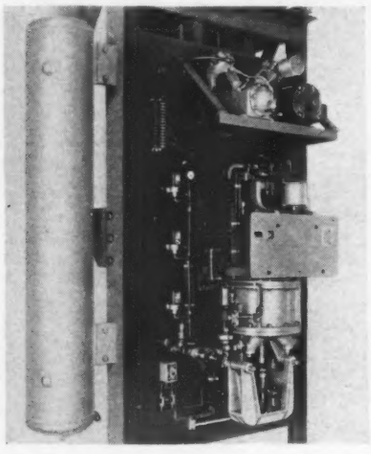
Stock No.		Dimensions — Inches					Approx. Shpg. Wt., Lbs., 100 Pcs.			
							Standard		With Block	
Standard	With Block	Pole Bolt Spacing	Diam. of Pole	Diam. of Mtg. Bolts	Pin or Post Spacing (Center to Center)	Size Pin Hole	No.	Wt.	No.	Wt.
6320	5920	8	5 1/2 to 6 3/4	5/8	12	1	6320	2800	5920	3230
6321	5921	8	6 3/4 to 8	5/8	12	1	6321	2800	5921	3230
6322	5922	8	8 to 8 1/2	5/8	12	1	6322	2800	5922	3230
8420	7420	10	5 1/2 to 6 3/4	5/8	12	1	8420	2800	7420	3230
8421	7421	10	6 3/4 to 8	5/8	12	1	8421	2800	7421	3230
8422	7422	10	8 to 8 1/2	5/8	12	1	8422	2800	7422	3230

HUBBARD HARDWARE!"

NEW EQUIPMENT

Breaker Operator

Pneumatic operator to provide high-speed operation of large outdoor oil circuit breakers consists essentially of air cylinder and piston and a mechanically trip-free mechanism. Operator is said to be especially suitable for fast reclosing service, reclosing times within 20 cycles (60-cycle timing) having been obtained when using it in conjunction with a standard 69-kv., 600-amp., 500,000-kva. outdoor oil circuit breaker. Device is also suitable for installations where a d.c. supply is not available and where operation from an a.c. source through a rectifier is not considered desirable, the manufacturer states.



Type "PN-700" pneumatic operator; uses normal operating pressure range from 80 to 125 psi.; air compressor operates on 220-volt, single-phase a.c. **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

•

New Porcelain

"Prestite" porcelain. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

New type of electrical porcelain is said to have dielectric strength of wet process porcelain with mechanical strength about 10 per cent greater under tension and cantilever loads, to be impervious to moisture and to have the same resistance to heat shock as other types of porcelain. Dimensions of the material can be held accurate within 1½ per cent, according to the company, who report that for a given dielectric strength, a part made with this porcelain can be made about a third the size of the equivalent dry-process piece; for the same mechanical strength, size reduction varies from about 10 to 30 per cent, depending on the kind of load carried.

•

Fluorescent Lamp

"Soft white" fluorescent lamp. **Hygrade Sylvania Corp.**, Salem, Mass.

This company adds the "Soft white" shade to its fluorescent lamp line. Lamps are offered in 14-, 15-, 20-, 30- and 40-watt sizes.

•

Guy Strand Holder

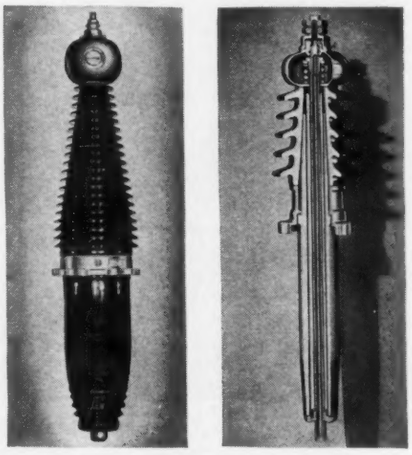
Holder has been designed to provide a safe, practical way of handling guy strand wire. Coil, with binding wires intact, is rolled into the holder and secured with a latch. When binding wires are removed, strand expands to fill the holder, which may be carried to the job on the truck and then to the pole on the shoulders of the lineman. In the field, the strand is dispensed from the inside of the coil.

"Jenne" guy strand holder and dispenser; accommodates coil of wire to 30 in. in diameter and 6½ in. deep. **Malleable Iron Fittings Co.**, Branford, Conn.

BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Apparatus Bushings

Four improvements in this company's oil-filled apparatus bushings are complete sealing, magnetic oil level indicator, greater use of internal porcelain and interchangeable terminal system for transformer units. Bushings still make use of porcelain as main internal dielectric and full compression type of assembly with butt-type joints. On magnetic oil level indicators, permanent magnet to which dial pointer is attached follows movement of similar magnet operated by pivot float within oil reservoir.



Class "L" bushing; sectional view, showing new type of oil expansion chamber to provide complete sealing; Class "G" bushing, with magnetic oil level indicator. **Ohio Brass Co.**, Mansfield, Ohio.

•

New Relay

Type "CAN" relay for a.c. secondary network systems. **General Electric Co.**, Schenectady, N. Y.

New relay for a.c. secondary networks, described by D. L. Beeman of this company at the recent A.I.E.E. convention, is stated to have materially improved characteristics over previous designs and to be more efficient, smaller and faster.

•

Insulating Varnish

"Harvel 612-C" varnish. **Irvington Varnish & Insulator Co.**, Irvington, N. J.

Improvements in speed of cure, flexibility adequate to withstand all internal

"OF COURSE WE'RE BUSY"

but... we are very definitely interested in seeing that you — our regular and prospective customers are supplied with all of the Simplex wires and cables that you need now for your business. When the present emergency is over it will be you who will keep our plant running. When that time comes we do not want you to let us down. We shall do our best not to let you down now although adding wires and cables for the defense program to our regular business has our plant working night and day.

We know that at times there are going to be delays. You realize that too. But we are going to see that regardless of the delay you get the cables you want in the way you want them just as quickly as it is possible to get them to you. Needless to say, the same Simplex quality that has made Simplex wires and cables outstanding for over half a century is not going to suffer in this emergency.

If you have a wire or cable problem we shall be glad to help you with all of the engineering service that we have available. When you need wires or cables we will use every effort to get them to you when you want them and as you want them.

Simplex Wire & Cable Company, 79 Sidney Street, Cambridge, Mass.

SIMPLEX WIRES CABLES

When Judy O'Grady Pays Her Bill—
Is It a Profit? Or a Loss?

Judy O'Grady Would Like to be a Profit Customer for You--Because She Wants Electric Cooking!

Many a low-income "Judy O'Grady" has already been educated to *want* electric cooking. When she buys it, she is no longer a loss-customer on your books.

Make the Judy O'Gradys profitable by offering them the ranges they can afford. Electromaster has them.

Most important: Electromaster has a program to insure your sales success with "Judy O'Grady" Ranges. Many Utilities are using this program successfully.

Let us have a talk with you about converting Judy O'Grady from a liability to a profit-maker. For your convenience, use the coupon below.

(For Electric Utility Executives Only, Please)

ELECTROMASTER, INC., 1803 E. Atwater St., Detroit, Michigan

Yes, we'd like to look over this plan—particularly your proofs that it works. This request puts us under no obligation.

Utility .....

By .....

Title .....

Address .....

stresses due to thermal expansion and contraction of windings are claimed for this new formulation of insulating varnish. A phenol-formaldehyde synthetic resin-base varnish made from cashew nut shell liquid, it is internal drying. Vibration-resistant, the new varnish is said to possess unusual retention of insulating strength at high operating temperatures, such as encountered with Fiberglas and other Class "B" insulated windings.

•

Printer

Light source of this printing machine is a 55-watt mercury-vapor quartz lamp, installed in a revolving 9-in. "Pyrex" contact cylinder. The 42-in. printer operates with

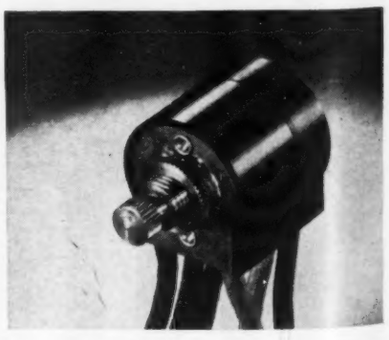
Model "55" printer; 32 in. wide, 62 in. long and 48 in. high; for 220 volts, 60-cycle or 220 volts, 50-cycle a.c.; 3,800 watts. **Charles Bruning Co., Inc.,** 100 Reade St., New York, N. Y.

either cut sheets or roll stock and prints ink tracings at from 12 to 15 feet per minute, according to the manufacturer. Speed indicator is placed at the center of the front, above the feed board. Print and tracing return is a design feature; top of the machine serves as a return tray and the return is so designed that the tracing enters the trap on top of the print—in the same way it is inserted in the machine. No reversing of the tracing is necessary when inserting it in the machine; exposed sheets stack themselves as they emerge from the printer onto the tray. Double centrifugal blower, resiliently mounted transmission and motor are features making for quieter operation.

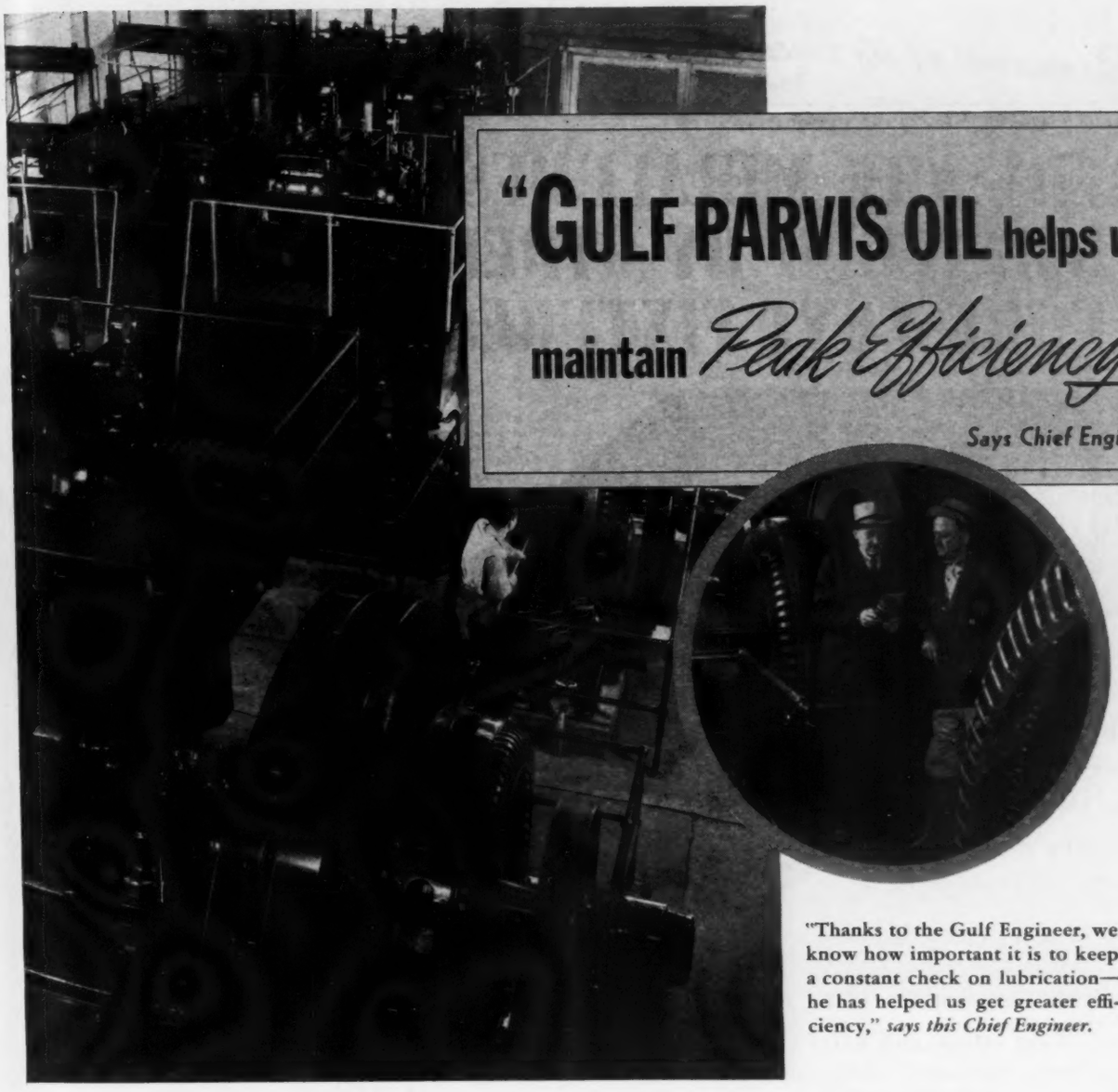
•

Lamp Switch

Manually operated switch housing for fluorescent lamps is produced from heat- and moisture-resistant Bakelite phenolic material, said to be high in electrical



Fluorescent lamp switch; single- and two-lamp designs. **Jefferson Electric Co.,** Bellwood, Ill.



"GULF PARVIS OIL helps us maintain *Peak Efficiency*"

Says Chief Engineer

"Thanks to the Gulf Engineer, we know how important it is to keep a constant check on lubrication—he has helped us get greater efficiency," *says this Chief Engineer.*

"GULF PERIODIC CONSULTATION SERVICE proved that lower maintenance costs were possible in our plant"

"GULF PARVIS OIL helps to keep our Diesels in perfect operating condition," says this Chief Engineer. "It's the most satisfactory Diesel lubricant we've ever used. Our maintenance costs are lower, and we get better protection for cylinders, bearings, and pistons."

More than 50 leading Diesel manufacturers recommend Gulf Parvis Oil for use in the Diesels they build! Many outstanding records of low-cost Diesel operation are being made with Gulf Parvis Oil. Ask the Gulf Engineer how you can benefit from GULF PERIODIC CONSULTATION SERVICE. Through this practical service plan you can improve the operation of your Diesels and reduce maintenance costs. Write or phone your nearest Gulf office today!

GULF INDUSTRIAL LUBRICATION

This booklet will suggest to you a practical method by which you can improve production and reduce operating costs. Write for your free copy.

Gulf Oil Corporation - Gulf Refining Company
3800 Gulf Building, Pittsburgh, Pa. E.W.

Please send me my copy—no charge—of the booklet "GULF PERIODIC CONSULTATION SERVICE."

Name .....

Company .....

Address .....

Fluorescent at its Finest by HYGRADE the pioneers

WHY ARE MIRALUMES UNMATCHED BY OTHER FLUORESCENT FIXTURES?

NEW MIRALUME HF-100: 100-watt unit; 2 40-watt lamps; no nuts or bolts to mar porcelain enameled reflector.

No other fixtures offer Hygrade's big advantages and complete guarantee!

Listen to the *exclusive combination* of advantages you can offer your customers in Hygrade MIRALUMES! . . .

Finer light (Hygrade's patented lamp coating) . . . *sure, trouble-free starting* (Hygrade's patented Mirastat starters) . . . *lower maintenance* (Hygrade's easily demountable reflectors and sturdy lamp holders) . . . plus *a complete guarantee* covering every part!

MIRALUMES are *quality-manufactured* . . . better designed and engineered . . . sold wired, ready to install, complete with *superior* Hygrade Lamps . . . Underwriters Laboratory approved!

Every day, we are striving to improve product quality and further stimulate interest in better lighting—a policy which we believe justifies your fullest support of Hygrade MIRALUMES!

NEARLY 100 PATENTS PROTECT HYGRADE'S PRODUCTS

Extraordinary lighting efficiencies are obtained in Hygrade Fluorescent Lamps by tuning the ultra-violet energy to the 2537 Angstrom Units wave length effective in causing the porous film (Hygrade Patent #2,096,693) to generate light as shown in Hygrade controlled Patent #2,126,787. Hygrade products are exclusively protected by nearly a hundred other patents, including #2,201,317 and #1,982,821.

EVERY MIRALUME EMBODIES A HIGH POWER FACTOR, LOW STROBOSCOPIC CIRCUIT

Hygrade MIRALUMES

World's Only Completely Guaranteed Fluorescent Lighting Fixtures

Hygrade Sylvania Corp., Ipswich, Mass. Est. 1901. Makers of Hygrade Fluorescent and Incandescent Lamps and Sylvania Radio Tubes

resistivity. Switch is operated in a clockwise direction, the line current being first closed, sending current to the starting filament. Then the filament circuit is broken —the switch now being in the "on" position—and the arc is formed in the lamp.

•

Tube Coating

For applying protective coatings to the interior of boiler, economizer, condenser and other accessible tubing, this company announces a new automatic tube coating machine said to help the handling of long horizontal, bent or vertical tubing, with considerable savings in labor and material.

"Apexior" tube coating machine. **Dampney Co. of America,** Hyde Park, Boston, Mass.

Automatic feed-to-brush equipment consists of a pressure-feed container equipped with adjustable coating-pressure regulation. It operates with air-motor agitation, a single air-fluid line and forced feed to the expanding brushes through the air turbine. Coating is discharged into the path of the rotating brush as the coating unit is withdrawn.

•

Electric Hoist

"Zip-Lift" electric hoist, in 250-, 500-, 1,000- and 2,000-lb. capacities. **Harnischfeger Corp.,** Milwaukee, Wis.

Features of this electric wire-rope hoist, powered from an ordinary light circuit, include double brakes, automatic limit switch and fully enclosed construction. Push-button cable control is anchored to hoist frame, so that operator can pull hoist along trolley by means of cable. Hoist can be mounted rigidly or on hook or trolley.

•

Room Ventilator

Room ventilator; weight, 26 lb.; in cabinet 11 in. high, 16 in. wide and 14 in. deep. **Air Conditioning Div., Philco Corp.,** Philadelphia, Pa.

For residential and commercial use, this room ventilator will bring in fresh filtered air from the outside at the maximum rate of 475 cu. ft. a minute or clear the room of stale air at the rate of 110 cu. ft. a minute. Controls may also be adjusted to recirculate room air, adding desired amount

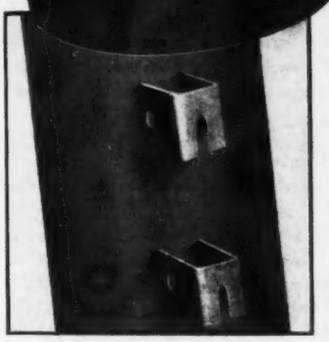
NEW MOLONEY TYPE KL AND CL DISTRIBUTION TRANSFORMERS

Conforming with E.E.I.-NEMA Standards

TYPE KL

TYPE CL

- Lower cost on Transformers without taps.
- Standardized location and uniform spacing of new "jump-proof" transformer mounting lugs.
- Standardized locations of all bushings.
- Standardized nameplate location. Tap voltages given in per-cent of rated voltage.



THE NEW STANDARD MOUNTING LUGS

Operating companies whose requirements can conveniently be adapted to the new standards, can effectively cut costs by using the new Moloney Type KL or Type CL Transformers.

Save through unification and simplification. With the new transformers, uniformity of installation is possible as a result of its standardized construction.

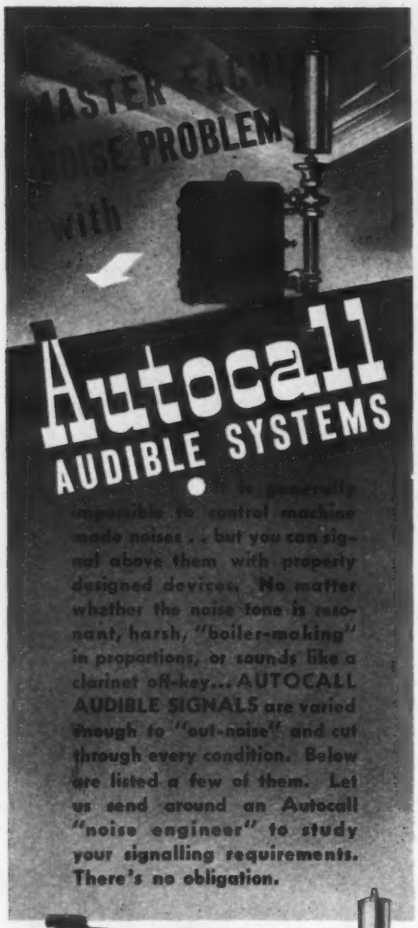
The transformer stocking problem is simplified since all makes of transformers conforming to the new E.E.I.-NEMA standards are interchangeable.

Save through using transformers without taps. Transformers without taps are now priced lower than those with taps.

Save through lower maintenance costs made possible by regular Moloney features including, higher insulation level that reduces outages resulting from surges, compound impregnated windings, core-and-coil units anchored to tank above oil level, and ratio adjusters on transformers supplied with taps.

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U.S.A.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896



INCREASE PLANT EFFICIENCY

Let us tell you more how Autocall can help you in this direction. Check the items below in which you are particularly interested.

- ☐ A. C. Network Supervisory Systems
- ☐ Automatic Recording Meters
- ☐ Power Plant Supervisory Systems
- ☐ Oil Filled Cable Supervisory Systems
- ☐ Supervisory Control Systems
- ☐ Electronic Signalling Equipment
- ☐ Recording Ammeters ☐ Diagram Boards
- ☐ Special Lamp Annunciators
- ☐ Special Control Systems ☐ Paging Systems
- ☐ Relays, Special Devices & Liquid Flow Indicators
- ☐ Special Steel Cabinets, Bench Boards and Panels

A complete staff of electrical and mechanical engineers and physicists, available for special designs to meet individual problems.

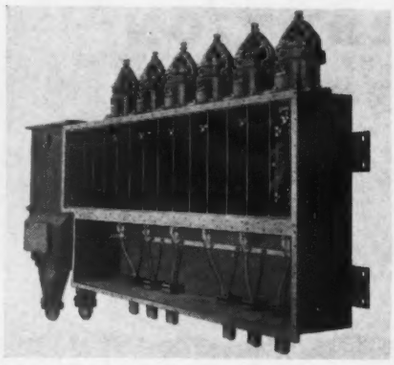
THE AUTOCALL COMPANY
406 Park Ave. SHELBY, OHIO

of fresh air. Installed in the window, the unit operates on being plugged into the socket.

•

Metal-Clad Units

Metal-clad units combining two or more devices which are ordinarily separate are a recent development of this company. Vault unit illustrated has a double-throw



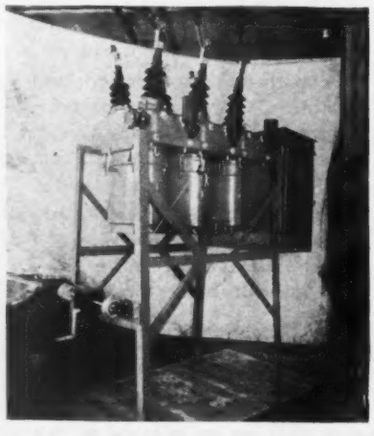
Type "RAFCBH" vault unit. G. & W. Electric Specialty Co., Chicago, Ill.

selector oil switch (at the far end), six oil fuse cutouts on top, all attached to a disconnecting link box having the conduit entrance compartment below. Busses in the box are fed from either one of two incoming circuits. Two banks of transformers are connected through disconnecting links in box and in series through oil fuse cutouts to bus bars.

•

Oil Breakers

Outdoor oil circuit breakers designed for general distribution service are of the multiple single-pole construction. The weatherproof units make use of the inverted-type high-pressure finger contacts and feature magnetic blowout barriers and arcing horns. Both moving and stationary main contacts are silver-plated. Breakers can be supplied for manual operation or for



Classes "250-OS-150" breaker in 1, 2, 3 or 4 poles, 600 or 12,000 amp. at 15 kv.; "250-OS-230" breaker in 1, 2, 3 or 4 poles, 600 amp. at 23 kv. Roller-Smith Co., Bethlehem, Pa.

electrical operation by d.c. solenoid or d.c. solenoid and a.c. rectifier. Electrically operated breakers may be equipped for automatic reclosing duty.

Crapo
GALVANIZED STEEL
STRAND

RUGGED STRENGTH AND LONG LIFE AT LOW COST

EVERY physical characteristic essential to high strength, long life and trouble-free maintenance is combined —with sound economy—in *Crapo* Galvanized Steel Strand.

The superior tensile properties inherent in steel are used to fullest advantage in this time-proved product. The heavy, ductile, tightly-adherent zinc coatings—applied by the *Crapo* Galvanizing Process—provide lasting protection against corrosion, increase the life of the strand beyond the normal period of replacement. Correctly controlled ductility makes *Crapo* Steel Strand easy to serve. Characteristic ruggedness enables it to withstand the punishment encountered both in construction and in service.

The low first cost and low yearly cost of *Crapo* Galvanized Steel Strand result in important economies to many of America's leading utilities. *Crapo* Galvanized Steel Strand is available in all standard grades and sizes from representative jobbers located in principal distributing centers. Consult the distributor of *Crapo* Galvanized Products near you, or write direct for further information!

Crapo Galvanized Products also include *Crapo* HTC-130 and HTC-80 Steel Conductors (Solid and Stranded 3-Wire), Construction Wire, Tie Wire and Ground Wire.

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

MANUFACTURING - MARKETS

Electrical Orders Set Record in '40

Electrical goods orders during 1940 were the largest on record, amounting to $1,433,377,755, a gain of 64.8 per cent over 1939 and of 34.6 per cent over 1929, the previous record year, according to the Bureau of Census.

Orders booked during the fourth quarter of 1940, as reported by 78 manufacturers, set a record for the second consecutive quarter, totaling $514,816,295, as compared with $411,595,431 in the third quarter and with $254,302,071 in the fourth quarter of 1939.

Bookings reported for each quarter include data for electrical motors, storage batteries, domestic appliances, industrial equipment and other electrical apparatus and supplies. While these do not constitute a complete statement of the industry, they are reported by the bureau as sufficiently representative to indicate the trend.

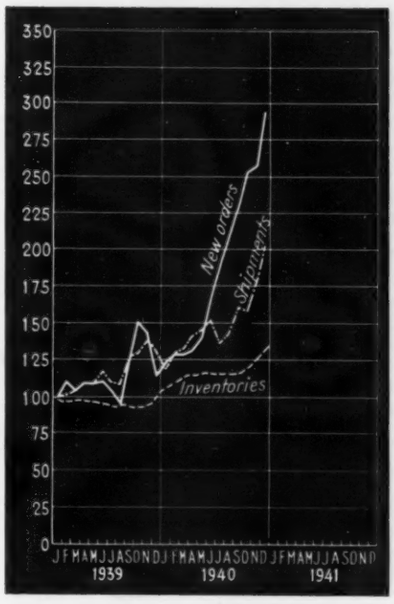
•

Machinery Orders Continue Advance

Manufacturers' new orders, shipments and inventories of electrical machinery continued to increase during December, according to the Bureau of Foreign and Domestic Commerce indices, and the pace was quicker than for all durable goods industries. Shipments continued well behind new orders, however, resulting in another increase in unfilled orders.

The index of new orders for electrical machinery rose to 293 for December, as compared with 258 in November and 115 in December, 1939. For all durable goods industries—excluding railroad equipment for December, 1940—the new figure was 248, as against 234 in November and 114 in December a year ago. Index figure for shipments of electrical machinery stood at 201 for December, compared with 178 in November and 129 for December of the previous year. For all durable goods industries the December index was 186, compared with 172 in November and 147 for December, 1939.

Manufacturers' inventories of electrical machinery reached an index of 133.8 as of December 31, as compared with 126.8 for November 30 and 103.9 for December 31, 1939. For the durable goods industries the new index figure was 128.0, compared with 124.1 and 110.3. Unfilled orders of electrical machinery rose 16 per cent for December over November, compared with a gain of 14 per cent in the preceding month. For December, 1940, over December, 1939, the gain was 208 per cent. For all durable goods reported the rise in unfilled orders during December was 9 per cent, as compared with 13 per cent in November.



ELECTRICAL MACHINERY indices reported by Bureau of Foreign and Domestic Commerce

Westinghouse Gets Defense Lamp Order

Thirty-five thousand Westinghouse 48-in., 40-watt fluorescent lamps, said to be the largest single order on record for such lamps, have been ordered for a new plant of the Vega Airplane Co., Lockheed Aircraft Corp. subsidiary, at Burbank, Calif. Delivery of the lamps, which will illumine two new manufacturing and assembly floors, a fabrication section, warehouses, drafting rooms and general offices, is expected to be completed about March 15.

Manufacturing and assembling floors and the fabrication section, comprising a total floor area of 240,000 sq.ft., will be illumined at an average intensity of 45 foot-candles on a working plane 3 ft. above the floor. Lighting load for these areas will be about 1,679 kw. General offices will be lighted at an intensity of 35 foot-candles.

Open-end porcelain RLM-type fixtures, some housing four lamps each and others two, are being mounted in parallel rows 40 ft. above the floor in the manufacturing and assembling departments and the fabrication section. Rows are 8½ ft. apart. Open ends of the fixtures in each row are 17½ in. apart. Open-end two-lamp fixtures are used on balconies. Inclosed-type two-lamp fixtures are being installed in offices and drafting rooms. Westinghouse two-lamp ballasts will be used; to date the airplane company has ordered 10,000 of these units.

•

Pays on Accumulations

Directors of Graton & Knight Co. have declared a dividend of $1.75 per share on account of accumulations on the 7 per cent cumulative preferred stock. The dividend was payable February 15 to holders of record February 5.

Manufacturers Issue Earnings Reports

Among electrical manufacturing companies recently issuing earnings reports are the following:

ELECTRIC CONTROLLER & MANUFACTURING—For 1940, net profit, $506,708, equal to $7.15 each on 70,855 shares of capital stock, compared with 1939 net of $158,115 or $2.23 a share.

COPPERWELD STEEL—Preliminary report for 1940, net earnings, $1,140,982, compared with $934,348 for 1939. Such preliminary figures are equal, after preferred dividends, to $1.99 per share on 514,864 shares of common presently outstanding, compared with $2.05 per share on 431,714 shares of common outstanding at the end of 1939.

CORNELL-DUBILIER ELECTRIC—Fiscal year ended September 30, consolidated net income, $635,987, equivalent to $2.40 per share, compared with $183,722 for fiscal year ended September 30, 1939, which was equivalent to 69 cents per share.

ACME STEEL—Including subsidiary, for 1940 (preliminary), net profit, $2,127,444, equal to $6.48 a share on 328,108 shares of $25 par capital stock, compared with 1939 net of $1,908,609, or $5.82 a share. In 1939 normal taxes totaled $834,566 and excess profit taxes $570,279. December quarter: net profit, $479,352, equal to $1.46 a share, against $602,688 or $1.84 a share in preceding quarter and $872,506 or $2.66 a share in final quarter of 1939.

•

International G.E. Sells Siemens & Halske Holdings

International General Electric Co., subsidiary of General Electric Co., has sold its holdings of bonds of Siemens & Halske, A. G., German electrical manufacturer. The block consists of $10,000,000 face value of bonds and the purchase price was in excess of the face value.

•

Reliance Electric Pays Dividend on Common

Reliance Electric & Engineering Co. has declared a dividend of 25 cents per share on the common shares of the company, payable March 21 to stockholders of record March 11.

In 1940 the company made payment of 25 cents in March, 25 cents in June, 37½ cents in September and 50 cents in December, a total of $1.37½ for the year.

New York Metal Prices

	Feb. 18, '41 Cents per Pound	Feb. 11, '41 Cents per Pound
Copper, electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.65	5.65
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	51.50	50.25
Aluminum, 99 Per Cent	17.00	17.00

* Delivery Connecticut Valley.

Field Reports on Business

Utility and industrial plant expansion continues with placement of orders for equipment swelling backlogs of manufacturers. Priority of defense orders is likely to slow delivery of equipment to utilities. One utility has had its boiler tubes taken away from it twice.

NEW YORK

Orders booked by electrical manufacturers continue to increase, with government defense demands being given priority. One utility in this area has had its boiler tubes taken away twice because of defense needs. A tightening tendency in some lines is being noted, with some expectation that this condition will become worse.

I.E.S. Better Light—Better Sight lamp makers plan to spend more than $100,000 in their 1941 promotional campaigns. Utilities are to make greater effort to increase the light load. Oil burner sales are due for another lift this year and special emphasis is being made to new home builders. January sales of refrigerators and ranges rose sharply and the demand during the current month remains high. Washer sales have exceeded shipments and there are indications that production will have to be stepped up if current demands are maintained.

General Electric plans a new storage building in Pittsfield, Mass., to be completed during the summer. Westinghouse is to build a new plant at Fairmont, W. Va., to cost $3,000,000 to manufacture fluorescent lamps exclusively.

Industrial plant expansion is assuming sizable proportions. Several defense housing projects are being planned. Some large cable contracts have been let by the government. TVA and Bonneville are buying transformers, circuit breakers and switches. Other government agencies are buying reflectors, portable lights, electric ovens, cable, switches, capacitors, generating sets and transformers.

NEW ENGLAND

Union Electric Co. of Missouri has placed an order through the Boston offices of Stone & Webster Engineering Corp. for a G. E. 80,000-kw. steam turbo-generator. This unit will be installed in the Venice, Ill., No. 2 plant of this company. Negotiations for transmission line materials are very active; among these are several extensions necessitated to meet requirements of the war defense program. Electric cable contracts reported a short time ago for this area include $252,760 to Rockbestos Products Corp., New Haven, Conn., and $252,708 to Collyer Insulated Wire Co., Pawtucket, R. I.

Contracts for a wide diversification of electrical supplies placed in this area by the government during the past fortnight include $22,197 worth of signaling equipment to Gamewell Co., Newton Upper Falls, Mass.; generator parts to Hunt-Spiller, Boston, $17,672, and control units to Froiland Manufacturing Co., Springfield, Mass., $10,866.

B. F. Sturtevant Co., Boston, has received a contract for furnishing mechanical draft for Philo station, Ohio Power Co., and for Deepwater station, Deepwater Light & Power Co., Pennsgrove, N. J. Holtzer Cabot Electric Co., Boston, has received a contract for inverters, involving $198,000.

New England's largest defense housing project was started last week at Hartford, Conn., where 1,000 homes will be provided for industrial workers engaged on war defense work in the Hartford district. Domestic home building in Massachusetts for the current year promises to be on a very large scale and will require large quantities of electrical supplies. Major appliance sales are beginning to show a definite upward trend; large group orders for refrigerators in lots of 50 units up are reported by one distributor.

CHICAGO

Orders for a wide variety of electrical equipment are being received in exceedingly good volume as industrial activity continues to move along at capacity levels. As the defense program continues to gain momentum, the pace of incoming orders moves more rapidly ahead of production and delivery, with the result that there has been no opportunity to catch up on the increasing backlog. With the rapid expansion taking place in industrial plants, the demand for additional electrical apparatus holds at high levels.

Utility expansion throughout the Middle West is going forward at a rapid pace, with substantial orders being placed for new equipment. General Electric X-Ray Corp. will erect an addition costing $450,000, including equipment. Rock Island Lines has authorized an expenditure of nearly $8,000,000 for improvements during 1941, including $429,034 for signaling devices.

National defense contracts totaling $3,692,000 were placed here last week, which included the following orders for electrical equipment: Welding apparatus, $40,792; switchboards, $18,006; motors, $60,000; telephone apparatus, $70,845; generators, $22,000; wiring devices and fittings, $26,880; pumps, $10,444; radio equipment, $41,455; metering devices, $57,139; X-ray apparatus, $15,615; electric trucks, $12,977.

Dealers report excellent demand for electric appliances with sales averaging 15 per cent ahead of last year.

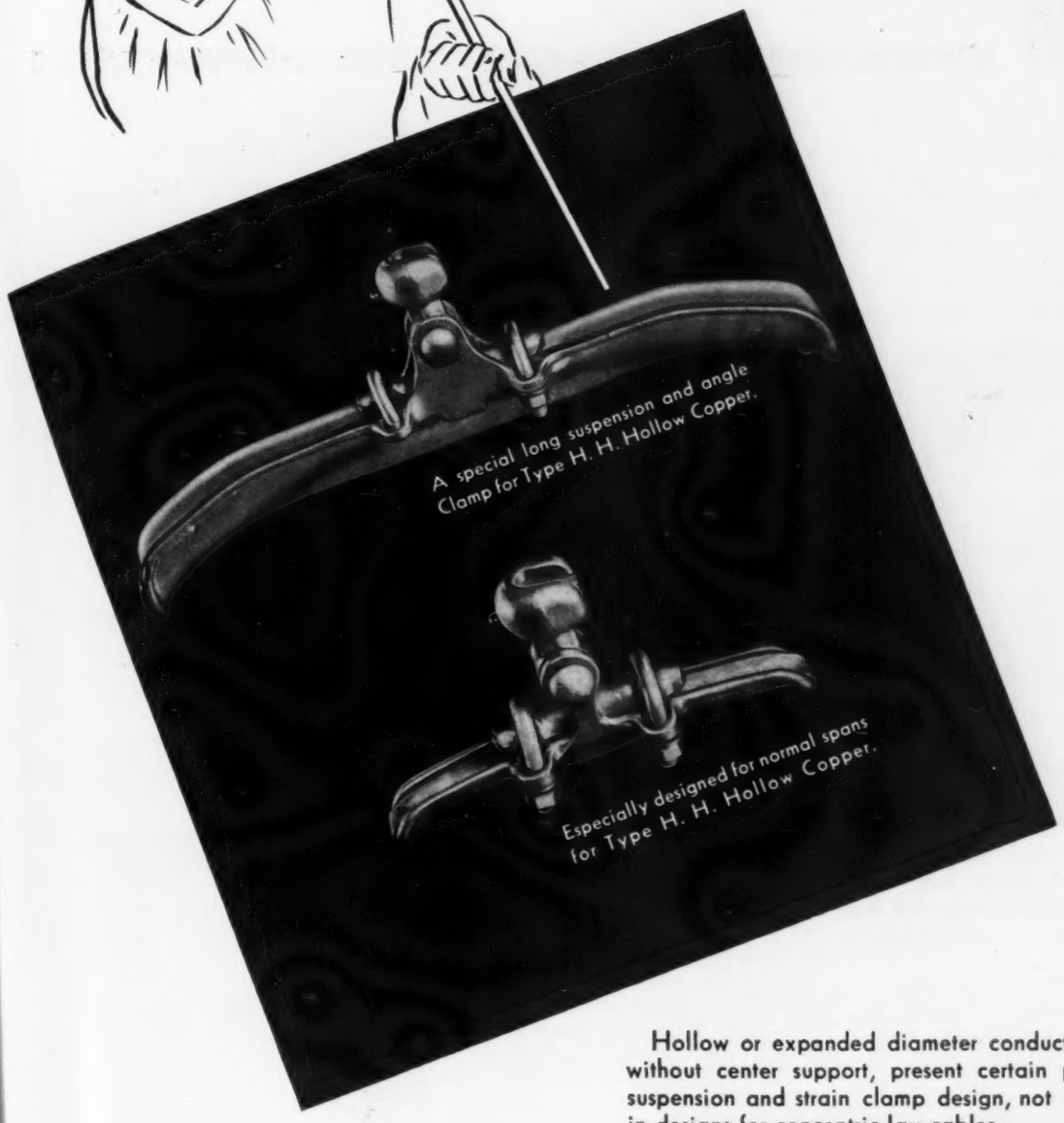
PACIFIC COAST

Large housing awards and projects, some defense, some municipal, feature current building construction. Included is a 1,000-dwelling contract for Pearl Harbor, Hawaiian Island; in addition to a $40,000,000 contract for similar defense housing and bases along the Pacific Clipper route. Regular private and public construction throughout the seven Western states during January showed a 50 per cent increase over last January, but a 10 per cent decrease from December.

Industrial orders include a group of motors, sizes 5 to 125 hp., for Columbus Steel, which is also planning a five-million-dollar expansion in Bay area; a $613,605 lighting set award from Air Corps to an Alhambra, Calif., manufacturer; seven 200-hp. motors costing $60,000 for a Utah copper mine; $17,000 of switchgears and transformers for a drydock contractor. General Electric reports a $75,000 order for miscellaneous control and energizing equipment for University of California Cyclotron or "atom smasher" at Berkeley. Pacific Gas & Electric Co. has appropriated $245,000 for replacement of 60-kv. by 110-kv. lines in the Soledad farming and dairying area in central California.

We Have the Answer

ON CLAMPS FOR Hollow Copper Conductors


A special long suspension and angle Clamp for Type H. H. Hollow Copper.
Especially designed for normal spans for Type H. H. Hollow Copper.

Hollow or expanded diameter conductors, with or without center support, present certain problems in suspension and strain clamp design, not encountered in designs for concentric lay cables.

We are prepared to recommend suitable designs on receipt of complete data as to cable source, design, diameter, ultimate strength, expected minimum and maximum vertical line angles, slip strength, etc.

Address inquiries to the attention of Engineering Department.

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

NEWS ABOUT PEOPLE

E. A. Lewis Assigned New Duties in Indiana

E. A. Lewis, vice-president and general manager of the Atlantic City Electric Co., Atlantic City, N. J., since 1931, has been appointed vice-president and

general manager of the Indiana & Michigan Electric Co., South Bend, to succeed the late T. F. English.

His first position in the utility industry was with the Public Service Co. of Northern Illinois in 1903. With this company he obtained practical experience in electrical work. He remained in the employ of this company until 1908, when he became affiliated with the electrical department of the Lincoln Park Commission of Chicago.

It was in 1911 that he went to Atlantic City, remaining there as general superintendent until 1919, when he went to the Scranton Electric Co., a subsidiary, in the same capacity. He returned to Atlantic City as assistant general manager, becoming vice-president and general manager in 1931.

•

▶ W. A. SUMNER has been appointed manager of distribution transformer engineering at the Westinghouse Electric & Manufacturing Co., Sharon, Pa. Following graduation from Yale University in electrical engineering in 1918, he joined the teaching staff at Yale and after a year became associated with Westinghouse, teaching for ten years in the Westinghouse technical night school. Since then he has been a section engineer at the Sharon Works.

•

Personnel Changes Made by Philadelphia Utility

Announcement has been made by the Philadelphia Electric Co. of various changes in organization.

The station operating department shall report to the vice-president in charge of engineering. The transmission and distribution department has been formed and shall include the Philadelphia and Suburban transmission and distribution divisions and the meter division. The appliance service division shall report to the manager of the service operations department.

R. G. Rincliffe was appointed manager of the station operating department; C. C. Baltzly continues as general superintendent.

Alex Wilson, 3d, was appointed manager of transmission and distribution department; G. S. Van Antwerp was appointed general superintendent.

C. D. Buchholz was appointed general superintendent of the service operations department, reporting to R. Z. Zimmermann, manager.

W. C. Pierson was appointed superintendent of the appliance service division.

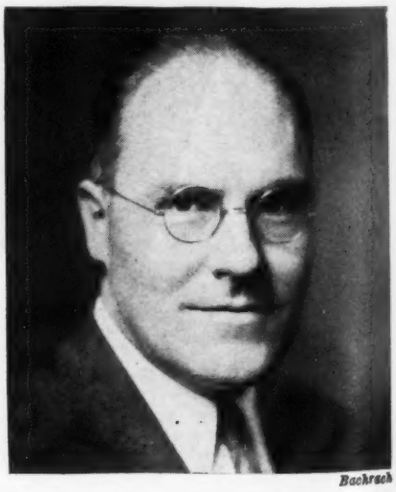
•

▶ ARTHUR L. CARVILL, formerly in the meter department of the Public Service Electric & Gas Co., Newark, N. J., has recently joined the electrical engineering staff of Ebasco Services Inc., New York City.

David C. Prince Nominee for A.I.E.E. Presidency

David C. Prince, manager of commercial engineering, General Electric Co., who has just received the nomination for the presidency of the American Institute of Electrical Engineers (ELECTRICAL WORLD, February 15, page 3), has been responsible for many improvements in the fundamental design of alternating-current locomotives, electric ship control, electronic tubes as power rectifiers, inverters for high-voltage d.c. transmission, mercury-arc rectifiers and oscillators. He introduced the oil-blast principle into oil circuit breaker design and is responsible for many developments in the new type of air-blast circuit breakers.

A native of Illinois and a graduate of the University of Illinois, Mr. Prince began his career in 1913 with a year's service in the test department of the General Electric Co., followed by three years as assistant to the electrical en-

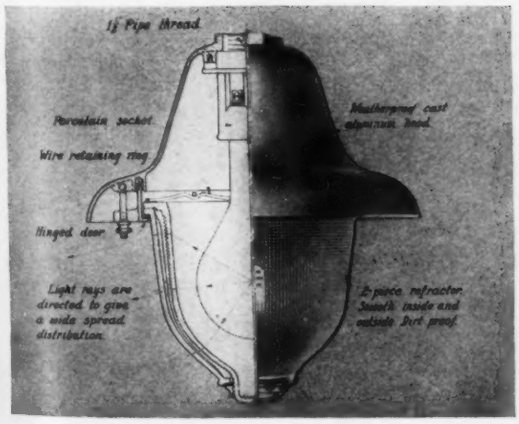


Bachrach

gineer of the Public Utilities Commission of Illinois, resigning in 1917 to take a commission in the Army. He was attached to the air service in Paris.

At the conclusion of the war he received a citation from Washington for

PROTECTIVE LIGHTING *puts the finger on* LAWLESSNESS


¾ Pipe thread
Porcelain socket
Wire retaining ring
Hinged door
Light rays are directed to give a wide spread distribution
Weatherproof cast aluminum head
2-piece refractor. Smooth inside and outside. Dirt proof

In periods of emergency, far-sighted plant managements are "policing with light" – to ward off the threat of sabotage, theft, espionage, fire and accidents. Holophane Refractors are miniature lighthouses both in performance and construction. Rugged, dependable and efficient, they can be installed with a minimum expense of time or money. No costly towers or circuits are required . . . They are built for unimpaired service under the most adverse conditions . . . They will *not* deteriorate – they are trouble-free and dust-proof . . . And they use ordinary lamps from 100 to 500 watts. Available for you immediately from your local distributors.

HOLOPHANE REFRACTORS

provide LOW COST *protection*

Without obligation the Holophane Engineering department will send a comprehensive book on protective lighting. Write for it TODAY.

Holophane

COMPANY, INC.
342 MADISON AVE.
NEW YORK CITY

Lighting Authorities—Since 1898
THE HOLOPHANE CO. LTD.
385 Yonge St., Toronto, Canada

Specify

SEYLER POLE LINE HARDWARE

★

We have, for twenty years, manufactured a complete line of Pole Line Hardware. Our line is complete and is quality material.

We have, throughout these twenty years, marketed our product under the trade name of others. As of this year, we discontinued selling through other manufacturers, and are now offering our materials under our own trade name.

As a user of the above commodities, as well as Galvanized Strand (Guy Wire), Chance or Everstick Anchors, Copperweld Rods and Clamps, we are quite eager to obtain a portion of your purchases, and will greatly appreciate receiving your inquiries and the opportunity of quoting.

We assure you, any business given us will be given prompt attention, and your valued business appreciated.

★

SEYLER MANUFACTURING COMPANY

Pole Line Hardware and Construction Specialties

Sharpsburg Post Office

PITTSBURGH, PA.

"especially meritorious service in the solution of engineering problems relating to aircraft." After the war he returned to General Electric in the radio department, transferring in 1923 to the research laboratory, and in 1931 was made chief engineer of the Philadelphia switchgear works. In 1940 he was promoted to his present position.

Mr. Prince is the author of 27 technical papers, many of which are important contributions to the scientific development of major apparatus. He is also the co-author of two books. Last year Mr. Prince was honored with the modern pioneer award for outstanding contributions to engineering science. He has to his credit 76 United States patents. He has served on various committees of the American Institute of Electrical Engineers and as a member of the board of directors.

•

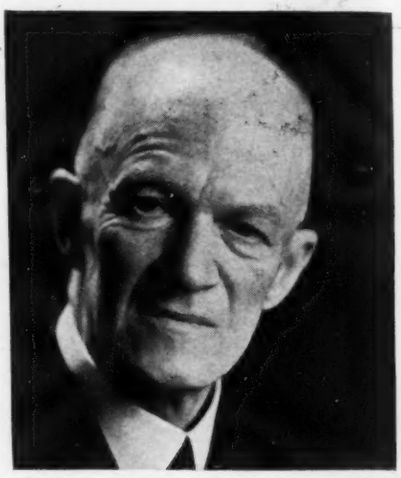
H. M. Hobart Resigns as G. E. Consulting Engineer

After more than 50 years of active participation in the development of the electrical industry in this country and abroad, Henry M. Hobart, internationally known engineer and author, has retired from service as consulting engineer with the General Electric Co., Although he reached retirement age in 1938, Mr. Hobart retained an office with the company and continued in a part-time consulting capacity until recently.

Born in Boston, Mass., he joined the testing department of the Thomson-Houston Electric Co., Lynn, Mass., immediately following his graduation from the Massachusetts Institute of Technology in 1889. Later he worked in Dr. Charles P. Steinmetz's office at the General Electric Co.'s Schenectady works, subsequently returning to Lynn. After serving with the British Thomson-Houston Co., in London the Union Elektricitäts Gesellschaft in Berlin, Germany, he returned to Schenectady in 1911 as consulting engineer with the General Electric Co., a position he held until his recent retirement.

In recognition of his persistent efforts in the advancement of welding research, Mr. Hobart was awarded the Samuel Wylie Miller medal of the American Welding Society in 1936. Mr. Hobart made extensive studies of induction motor designs and of the use of bare enameled wire in transformer windings where cotton coverings had formerly been considered necessary. He was also an ardent advocate of increased temperature rises in electrical apparatus. After becoming acquainted with the European advances made in mercury-vapor rectifiers about 1919, Mr. Hobart zealously worked for their introduction in the United States.

An author of numerous technical books and papers, Mr. Hobart is also the holder of some 30 patents, some in collaboration. He has served on various committees of the American Institute of Electrical Engineers and as its representative on the U. S. National



Committee of the International Electrotechnical Commission, (1914-32). Mr. Hobart has been particularly active in standards work and is also a member of the American Welding Society, American Society of Mechanical Engineers, American Association for the Advancement of Science and of the British Institutions of Electrical Engineers, Mechanical Engineers and Civil Engineers.

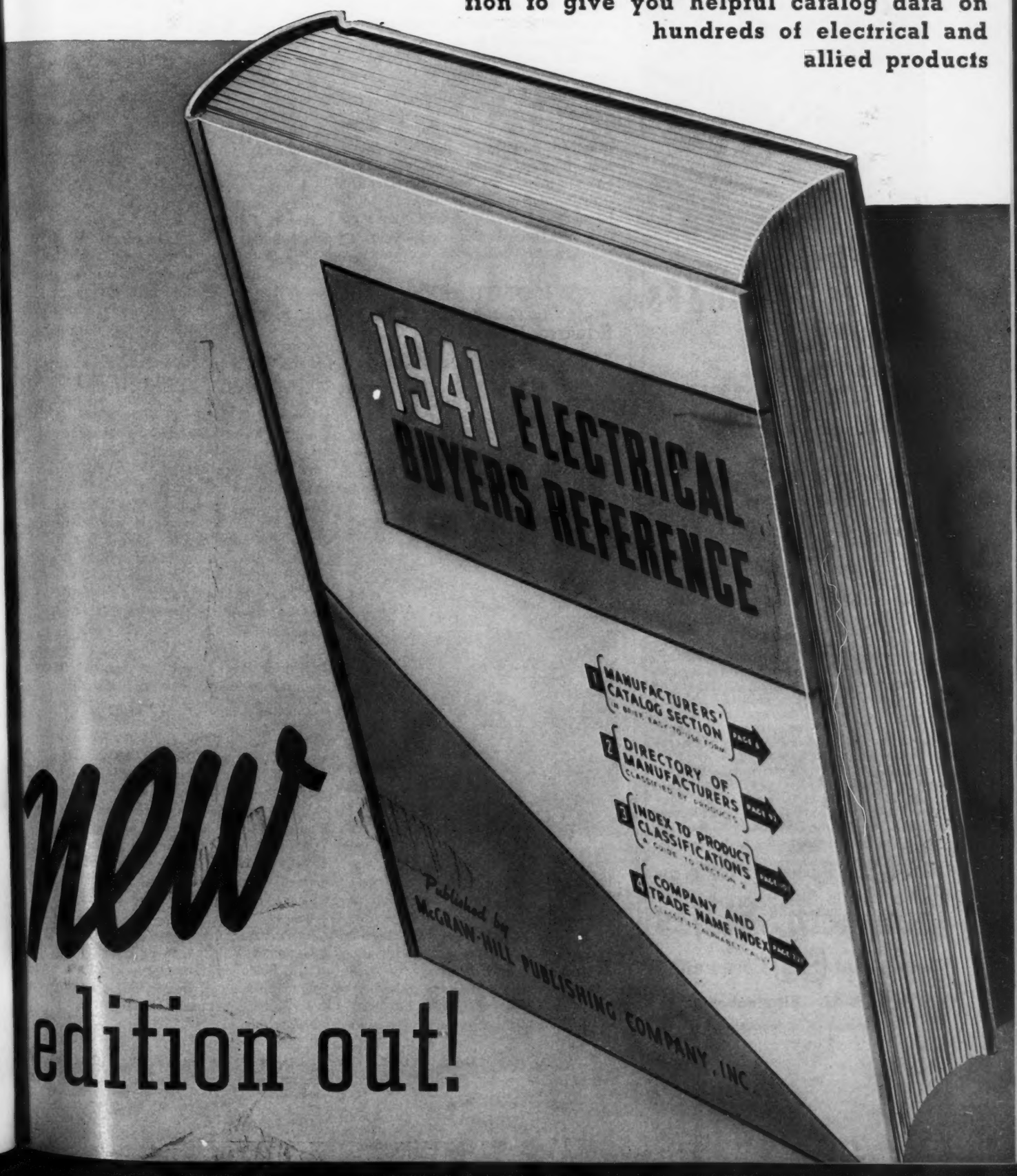
•

▶ HOMER B. WEST has been appointed manager of manufacturing in the transformer division of the Westinghouse Electric & Manufacturing Co. at Sharon, Pa. Mr. West's inventions while with Westinghouse have contributed notably to the design of modern power distribution transformers. He joined the company in 1919 in the power engineering department. Two years later he was transferred to the transformer engineering department and since 1935 has been in charge of instrument and regulator engineering.

▶ EDMOND S. MCCONNELL has been appointed engineer on the staff of the Edison Electric Institute in New York. Mr. McConnell received his engineering education at the University of Minnesota and Yale University. He was associated with the Anaconda Wire & Cable Co. from 1928 to 1937, first as district engineer at Chicago, and later as electrical engineer at Hastings-on-Hudson, New York. Subsequently he was in charge of the preparation of the Copper Wire Engineering Association's sag and tension charts for copper conductors, and later directed the associa-

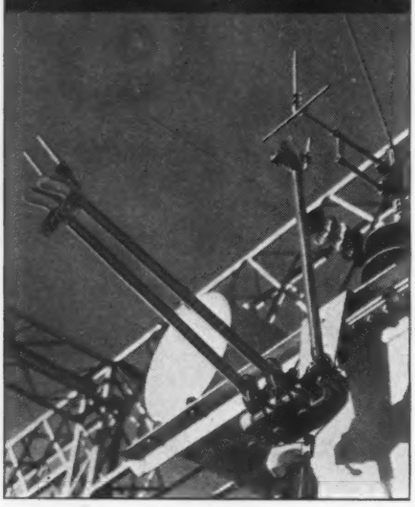
552 Pages of Up-to-Date Buying Data for You!

238 Manufacturers unite in this new edition to give you helpful catalog data on hundreds of electrical and allied products


1941 ELECTRICAL BUYERS REFERENCE
1 MANUFACTURERS' CATALOG SECTION
2 DIRECTORY OF MANUFACTURERS
3 INDEX TO PRODUCT CLASSIFICATIONS
4 COMPANY AND TRADE NAME INDEX
Published by McGRAW-HILL PUBLISHING COMPANY, INC.

new edition out!

FOR PROTECTION
from Lightning



Use Southern States Repeating

EXPULSION GAPS

Southern States Repeating Expulsion Gaps offer ideal protection from surges.

Southern States Repeating Expulsion Gaps are furnished with either rod or sphere gaps that are fully adjustable so that gap settings to suit each particular installation may be used.

Expulsion and arc extinction by Southern States Repeating Expulsion Gaps is so rapid that gap operation does not allow 2-cycle relays to operate, thereby permitting use of spill-gap protection for your important stations.

In each unit, reserve cartridges stand open in the manner of Southern States repeating fuses. This allows all gaps to provide desired protection, and prevents operation of more than one cartridge at a time; consequently Southern States Repeating Expulsion Gaps do not leave your equipment unprotected after one spill-over.

The high degree of protection, low maintenance cost, and absolute dependability of Southern States Repeating Expulsion Gaps have resulted in their extensive use on several major systems. Why not investigate the feasibility of their use on *your* system?

Your Southern States representative will be glad to talk with you further. Or write for Bulletin 152. It shows typical installations and gives complete information concerning Southern States Repeating Expulsion Gaps. We will be glad to send you a copy.

Send for Bulletin 152 Now

Southern States
Equipment (SS) Corporation
28 S. 20th St. Birmingham, Ala.
Representatives In Principal Cities

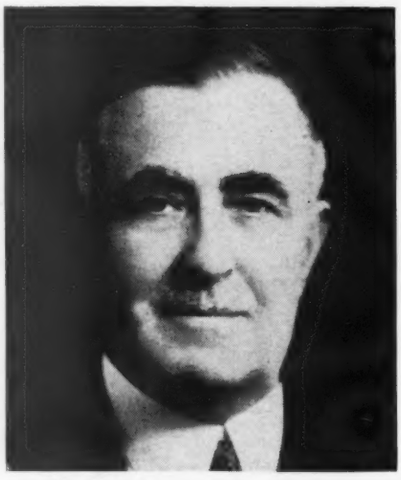
tion's field engineering service in connection with the rural distribution projects sponsored by the Rural Electrification Administration. More recently Mr. McConnell has been in private consulting practice relative to rural electrification projects.

▶ W. H. HARRISON, vice-president and chief engineer of the American Telephone & Telegraph Co. and past-president of the American Institute of Electrical Engineers, has recently been assigned broader duties under the reorganization of the original national defense commission into the more formal and authoritative Office of Production Management. Mr. Harrison now heads one of the three branches under John D. Biggers, OPM's director of production. His assignment covers all problems of keeping production humming in ships, construction, equipment and supplies. His former assignment with the defense commission, to which he went as a $1-a-year man last summer, was co-ordinator of construction contracts awarded by the government.

OBITUARY

Edward R. Grier

Edward R. Grier, chairman of Arrow-Hart & Hegeman Electric Co., Hartford, Conn., died suddenly on February 11, at Charleston, S. C., while on a motor trip. He was born at Mt. Joy, Pa., in 1869, and in 1887 became connected with the Marr Construction Co., Columbus, Ohio, in charge of inside



wiring. For many years he was employed by the Bryant Electric Co., Bridgeport, Conn., and from 1908 to 1927 was manager of the then Arrow Electric Co., Hartford. Upon the merger of that organization with the Hart & Hegeman company, he was elected president of the new establishment, becoming chairman in 1932. At the annual meeting of the National Electrical Manufacturers Association in February, 1938, he was one of six members of the association who were presented with engrossed certificates for having completed 50 years of continuous service in the electrical industry.

Mr. Grier was also vice-president of the Washington Porcelain Co., a director of Arrow-Hart & Hegeman, Ltd., of Canada, and of Arrow Electric Switches, Ltd., London, England.

•

Francis Jehl

Francis Jehl, one of Thomas A. Edison's assistants, whose death was announced in the February 15 issue of ELECTRICAL WORLD, page 10, took part in the experiments leading to the development and perfection of the incandescent lamp. In 1878 he became a laboratory assistant at Menlo Park, where he remained until 1882 when he went to Europe, spending forty years there building electric lighting systems.

He first did some construction work for the English Edison Co. and then went to the Continent, engaging in similar work for the French Edison Co. He made electrical installations in Austria and Rumania and in 1883 had charge of the Edison exhibit at the Vienna Electrical Exhibition. In 1914 he was decorated with the Knight's Cross of the Order of Francis Joseph by the Emperor of Austria-Hungary. He settled in Prague, but his travels took him everywhere. Mr. Jehl lost his savings of a lifetime in the World War and he returned to the United States in 1922. In recent years Mr. Jehl had been curator of the Menlo Park, N. J., laboratories of Edison, restored by Henry Ford at Greenfield Village, near Dearborn, Mich. He was 80 years of age at the time of his death.

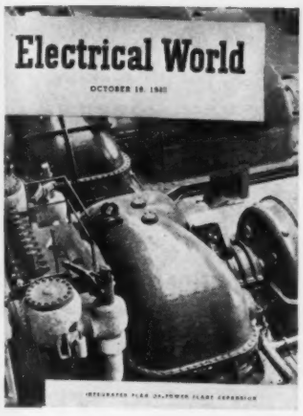
•

▶ RAY N. BAKER, assistant manager of the railway department of the Chicago office of the Okonite Company, died on January 3, following a brief illness. He was 69 years of age. For more than three decades Mr. Baker handled Okonite wires and cables among the railroads and public utilities —in the early days, as a representative of the Central Electric Co., Chicago (the company's former agent in the Middle West), and, later, as one of the original members of the company's Chicago office, which was opened in 1925.

▶ GARDNER W. PROUTY, 82, secretary of the Macallen Co., electrical insulation manufacturer, Boston, Mass., died at Littleton, Mass., on February 4, after a short illness.

Thanks to You

Electrical World continues to be the most VITAL magazine in its field.



YES, thanks to your cooperation with our editors, and with the trained inquirers whom McGraw-Hill sends out to interview readers, Electrical World continues to provide active leadership.

For, together with other McGraw-Hill publications, Electrical World has established a program of editorial research conducted by a staff of especially trained men. These interviewers make personal calls on subscribers at work in the field and in their offices in all sections of the country—to find out from them why they read Electrical World, how they use it, what they like best, what they pass up.

On each visit, a specific issue is gone through from cover to cover, and every page, every item, is weighted according to its value to the interviewed subscriber.

An original and farsighted step in journalistic practice, the idea behind the plan is to help the editors better to gauge the needs of subscribers so that they may provide a progressively better service.

This program can be successful only through your cooperation. Thanks to you, it has already been of tremendous help to our editors; and we are confident that the benefits of these interviews will be felt throughout Electrical World's readership.

In the hope that readers may find suggestions for new uses and applications for the magazine in the comments of other readers, we are publishing some of the remarks made during interviews held so far.

READER COMMENTS

"The type of article most useful to me is of a general lighting and merchandising nature. The news issue always interests me and the Personal section helps keep me up to date on the more important organization changes."

★

"'Street Lighting in Kingston'—That's right in my line. I copied some of the figures in there. We're about to go into a street lighting campaign so this article was doubly interesting."

★

"Had an interesting article about a year ago on Glass tape. Fact that salesman came through about same time made it more interesting. Knew about it before he arrived, thanks to E. W."

★

"Distribution Problems—very helpful pointers on different ways of doing. For instance, the article they had about Detroit—I followed out their idea and it's been directly helpful in many ways."

★

"Off peak water heaters—had a very interesting article about measuring the number of gallons of hot water used at time of peaks. Had a meter, but never knew at what time or how much the peaks were. The article straightened us out on this all right."

★

"My copy is made available to my men, most of whom read it with regularity. Articles of interest to my department are not only read by my men but clipped and filed under appropriate subject head."

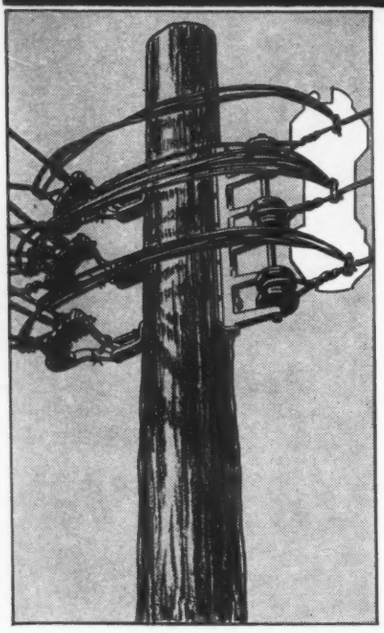
★

"Capacitors Release—This was right in my line—good articles. Commercial Cooking—I'm interested in load building. Editorials—I always read those, I like to get the editor's slant. Operating Practices—I usually find some pretty good information in this. Those outdoor regulators they have in Lynn interested me particularly. I think the magazine is pretty well balanced but of course I can always read more on distribution."

Electrical World

A McGraw-Hill Publication • 330 West 42nd Street, New York, N.Y.

modernize
YOUR
DISTRIBUTION
PRACTICE—



RELIABLE
MULTI-TAP
CONNECTORS

Provide neater more economical connection of service drop pigtails to secondary in crowded alley distribution.

One size accommodates No. 2 line wire and six No. 6 taps in a close fitting slot that assures dependable connections.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO, ILLINOIS

First a Mickle, Then a Muckle

[*Continued from page 62*]

plants, to be built by the government, at points considerably removed from the nearest government hydro development!

Don't imagine for a moment that, with the increasing insistence of government officials about the expected power shortage in various sections, that this notion of big government steam plants to prevent such shortages, real or fancied, has been entirely discarded. It is still very much in the picture, though temporarily in the background.

And never overlook for a moment that Chamber of Commerce spirit which makes any given community enthusiastic about the idea of big government spending within its boundaries.

•

Bonneville to Complete Northwest Grid System

Approximately $7,000,000 of the $12,957,900 Bonneville Power Administration appropriation proposed in the President's budget will be earmarked for the completion of the agency's 230,000-volt Northwest grid system. Approval of the appropriation will permit completion of a line between Grand Coulee and Covington, near Puget Sound, and construction of a new, third circuit between Bonneville and Vancouver, Wash. These two units will close a 650-mile circle of high-voltage lines linking both Grand Coulee and Bonneville dams with the major population centers of Oregon and Washington.

A total of $4,702,900 has been allocated for substations.

•

Seattle City Light 1940 Revenues Hit New High

Seattle City Light reports that 1940 revenues will reach a new high, and that with increased industrial activity resulting from the defense program 1941 is expected to show even greater returns.

E. R. Hoffman, superintendent, states that the 1940 revenue will reach $6,300,000, compared with $6,128,000 last year. Kilowatt-hours produced probably will reach 590,000,000 compared with 464,000,000 for 1939. The number of meters will have increased 3,000 and electric ranges 4,000.

READY NOW!
Your New
SHELDON
ELECTRICAL
Connectors
CATALOG

featuring all types of Electrical Connectors for use on

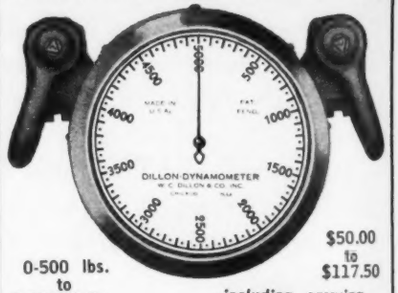
• TUBING
• CABLES
• FLAT BARS

This Connector Catalog contains complete data on electrical connectors for every Substation, Overhead and Underground need. Presents exclusive Sheldon Connector innovations that will save you money.

SEND FOR YOUR COPY OF CATALOG J . . . TODAY

SHELDON
SERVICE CORPORATION
Long Island City, N. Y.

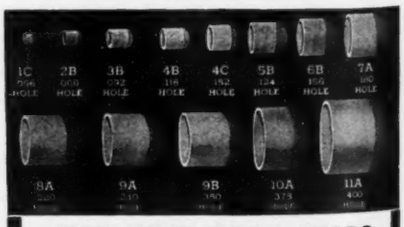
DILLON TRACTION DYNAMOMETER



0-500 lbs. to 0-15000 lbs.

$50.00 to $117.50 including carrying case and shackles

W. C. DILLON & COMPANY
5410 W. Harrison St. Chicago, Ill.



STAR INSULATING BEADS

Use Lavolain ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U. S. A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
TRENTON, N. J.

The 15th edition of this book is a veritable encyclopedia on Central Station practice—invaluable as a sales aid and engineering reference for manufacturers and distributors selling to this field, for consulting and power-sales engineers, public service commissions, financial houses. For the central stations themselves, it is an up-to-the-minute roster of the men in other plants whom they are anxious to keep in touch with for personal or business reasons.

This Latest Edition is a complete directory, classifying geographically all operating and holding companies in North America and U.S. possessions; also all plants, both privately and municipally owned. It contains an alphabetical index to all companies listed—over 4,000 of them. Listings include names and titles of all responsible officials; full data on power generation, transmission, distribution, number of meters, etc.

800 pages, strongly bound in flexible blue Fabrikoid; thumb indexed; size 4½ inches by 8½ inches. Published annually. Price $25.00 per copy. 10% discount on 5 or more copies.

Your Answer Book When You Want definite Information

on the Electric Utility Industry, such as—

...the name of the operating company or companies serving a given community

...the communities served by a given company

...the number of meters connected

...the number of rural customers

...ratings and types of units in generating plants

...type of distribution system and principal distribution voltage

...inter-company energy purchases

...names of the administrative, managing and operating officials listed by title for each of the companies

...information on holding companies, with cross-reference explaining the relationship with the operating company

In short, here's your most comprehensive, up-to-the-minute guide to the more than 4000 electric systems, private and municipal, in the United States, Canada and United States possessions.

Plant Equipment and Operating Data—The Central Station Directory lists for every plant its total generating capacity; the types and capacities of all prime movers and generating units; the voltages, phases, cycles and wiring of the distribution system; total number of meters connected, etc.

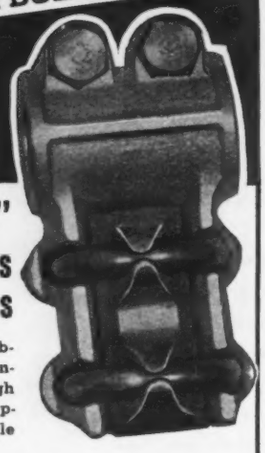
Personnel Data—The Directory lists all administrative, managing and operating officials by name and title.

Company Interlock—Full holding company data are given, with cross-reference explaining the relationship.

McGRAW-HILL PUBLISHING CO., 330 WEST 42ND ST., NEW YORK CITY

Catalog and Directory Division

DELTA-STAR
Bus & Cable Connectors
ASK FOR BULLETIN 38-D



TYPE "FTU"
SOLDERLESS CONNECTORS

For combination tubing and cable connections, with high compression clamping action for cable tap.
Used where long or strain leads are tapped from the tubing run. Cable grip insures good electrical connection and high mechanical strength.

DELTA-STAR ELECTRIC CO.
2400 BLOCK CHICAGO, FULTON ST. ILLINOIS.

CHECK
THE MAN WHO USES 'EM
SEYMOUR SMITH
TELEPHONE PRUNERS

Here's Why—

- A complete and flexible line to handle any and all wire clearing requirements
- Powerful, keen cutting action
- "Center Cut" blade operation
- Efficient in close, tangled growth
- Heavy duty, simplified construction
- Takes limbs up to 1½"diameter

WRITE FOR COMPLETE CATALOG

Seymour Smith TELEPHONE PRUNERS and Pruning Saws are standard equipment with many of the country's leading public utility companies. In efficiency and economy they out-perform all others.

Seymour Smith & Son, Inc.
28 Main Street, Oakville, Conn.

Recent Rate Changes

SOUTHERN CALIFORNIA EDISON CO., LTD., has made a reduction in its rate schedule amounting to $1,500,000, according to an announcement by Ray L. Riley, member of the California Railroad Commission. The new lower rates will be announced as soon as the staff of the commission and representatives of the company have completed the complicated work of making the new schedules. The new rates will become effective during the month of March, and it is believed probable that upon completion of the commission's study domestic and commercial rates will receive a greater portion of the reduction throughout the company's system.

WASHINGTON WATER POWER CO. has made a general rate reduction for customers in the Inland Empire, including north Idaho, amounting to $750,000 annually. The new rates became effective with all meter readings on and after February 3 of residential, commercial and industrial schedules. Approval of the reduction for Idaho customers was given by W. B. Joy, secretary of the Idaho Public Utilities Commission. It is estimated the new rates will result in an annual saving of $114,000 to the company's customers in the area, Mr. Joy said. He listed the probable savings as $71,500 to residential users, $32,500 to commercial and $10,000 to industrial consumers. Challenging the statements of public power advocates to the effect that the recent reduction of electric rates was to be nullified by a rate increase after the municipal election in Spokane, Kinsey M. Robinson, president of the company, said that general rate reductions never are made on a temporary basis. "We have made many reductions in the cost of electric service during the 52 years our company has served Spokane," Mr. Robinson said. "The average residential customer who today pays $3.70 for 158 kw.-hr. gets 64 per cent more electricity than he received for the same amount of money only ten years ago . . . Many of our residential customers are spending just as much or more for electric service as they did in 1900, but they are using the savings they have made through our rate reductions to bring them the added comfort and convenience of such modern electric appliances as ranges, refrigerators, radios and the numerous small appliances, in addition to proper lighting. We have never increased our residential rate schedules. With a continuance of the trend of increased use of electricity, which in Spokane is more than two and one-half times the national average, and the continued upward swing of business in the northwest, we can see no reason why our program cannot be continued with further reductions in the future, just as there have been in the past."

PORTLAND GENERAL ELECTRIC CO. has filed with the Oregon Utilities Commissioner reductions in commercial rates in Portland, Ore., and surrounding territory, totalling $485,000 annually, to be effective March 25. NORTHWESTERN ELECTRIC CO. will file identical schedule effecting a saving of $200,000 for their commercial users. This schedule is a straight block rate without demand charge for loads up to 10 kw. Steps in the rate are those advocated by the Bonneville Power Administration and the rates per kilowatt-hour are the Bonneville standard rate for commercial establishments plus a surcharge of 20 per cent, which is roughly the amount of the company's taxes. Steps in the rate start at 3½ cents for the first 150 kw.-hr. and run down through five steps to a charge of 0.63 cent per kilowatt-hour for all in excess of 100,000 kw.-hr. per

NEW BOOK
Just Out

Electric Distribution Fundamentals

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

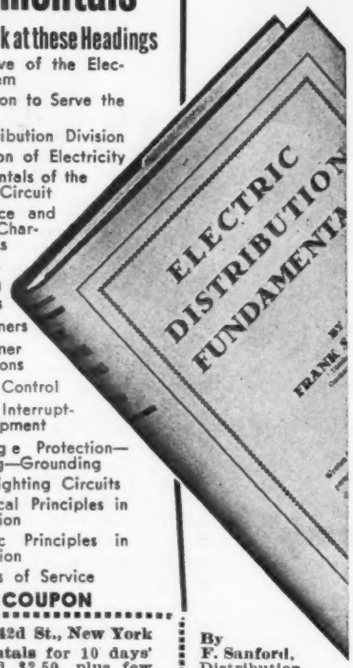
From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service



By F. Sanford, Distribution Engineer, Cincinnati Gas & Electric Co.

242 pages
156 illustrations
15 tables
1 chart

$2.50

10 DAYS' FREE EXAMINATION—MAIL COUPON

McGRAW-HILL BOOK COMPANY, Inc., 330 West 42d St., New York
Send me Sanford's Electric Distribution Fundamentals for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....
Address .....
City and State .....
Position .....
Company W-2-22-41

(Books sent on approval in U. S. and Canada only.)

month. the company considers the surcharge above the objective rate temporary, and expects to adjust it in the light of future increases in consumption or other circumstances permitting economies that can be passed on to the public. For loads above 10 kw. a demand charge of $1.14 per kilowatt is charged. The new schedule also provides for a rebate for load factors above 50 per cent.

Potomac Electric Power Co's "sliding scale" rate plan has resulted in a reduction of $338,000 annually in Washington on bills as of February 1. New rates filed by Potomac Electric Power Co. in compliance with the order of the Public Utilities Commission distribute the rate cut melon in proportion to the ratio of kilowatt-hours used by classes of customers in 1940. Bulk of the cut, more than $230,000, goes to commercial customers, with $89,585 to residential users and the rest to other small rate groups. The new commercial schedule "E" energy rate is, per kilowatt-hour: First 60 kw.-hr., 3.8 cents; next 190 kw.-hr., 2.2; next 1,750 kw.-hr., 2; next 48,000 kw.-hr., 1.1; next 155,000 kw.-hr., 0.7; excess over 205,000 kw.-hr., 0.6. New residential schedule is per kilowatt-hour: First 36 kw.-hr., 3.9 cents; next 100 kw.-hr., 1.8; excess over 136 kw.-hr., 1.5. This rate involves a reduction of the first energy block at 3.9 cents from 40 kw.-hr. to 36 kw.-hr., and an increase from 1.75 cents to 1.80 cents in the second energy block, which is increased from 90 kw.-hr. to 100 kw.-hr. Monthly savings will be 9 cents to users of 40 kw.-hr., 3 cents to users of more than 136 kw.-hr.

San Diego Gas & Electric Co. has reduced its electric rates $200,000 annually effective March 1 as a result of a co-operative investigation conducted by the California Railroad Commission. The reduction follows one of a like amount made just a few months ago. Commenting on the investigation Railroad Commissioner J. F. Craemer said in announcing the reduction: "The commission feels that it is proper at this time to commend the co-operative attitude of the city of San Diego and the San Diego Gas & Electric Co., in this as well as in past investigations made by the Railroad Commission. Since inception of the policy of continuous investigation four years ago, reductions in rates of this company have been found justified periodically. This has in a large part been due to the attitude of L. M. Klauber, vice-president in charge of operations of the company, and the cooperation of City Manager Walter Cooper and City Attorney D. L. Ault of San Diego."

Pacific Power & Light Co. has announced electric rate reductions in Clatsop County to save power users some $32,000 annually. The reduced rates became effective February 1. Reductions to residential customers will range between 8 and 16 per cent. Increased use of electric service in the area made the reductions possible.

Chester County Light & Power Co. has filed with the Pennsylvania Public Utility Commission a new rate schedule, effective February 1, which reduces the electric revenues of the company $3,800 annually.

Illinois Commerce Commission has announced that rate changes effective during the month of January resulted in an estimated reduction of $55,600 in annual operating revenues. Electric rate reductions amounted to $56,140, but telephone rate increases brought the total down to $55,600.

Ever Tangle a Guy Strand Coil?

When a coil of stiff guy strand gets out of control there is a considerable loss of time and a safety hazard involving both the line gang and passing traffic. This hazard can be minimized through the use of the Jenne Safety Guy Strand Holder. This Holder makes preferable the handling in coils

Guy strand coil is rolled into the Holder and latched in (left), carried to the job on the service truck and then to the anchor (center), where it is paid out from center of coil (right) for attachment to pole without attention at the coil.

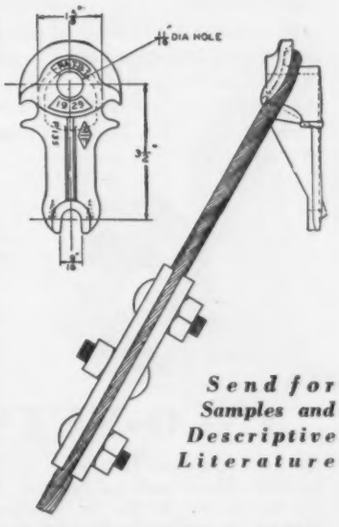
rather than on wood reels of stiff guy strand. Takes up less room in the truck, and strand may be paid out with Holder hanging on bracket on side of truck, and *without attention at the coil*. No more wire bindings, nor taping required to retain control.

This Safety Holder, *patented* by a practical Construction Supt., is made in the standard size to hold coils to 6½" x 30" overall, including practically all commercial sizes, and in a special smaller size for 4½" x 27" coils. Smaller coils expand to limit of four U-bands of the frame when the binding wires are removed. Loose ends of coil are then secured by placing through nearest of eight small retaining rings — securing of inner end being arranged for convenience in drawing out the strand from the center after the fashion of a coil of rope.

We suggest ordering one trial *PX80 Holder*, returnable for full credit after 30 days trial if unsuitable, although such trials have already led to numerous repeat orders in our limited introductory campaign, and less then 2% have been returned for any reason whatsoever. Standard finishes are aluminum paint or red enamel, priced at $8.00 net, F.O.B. Branford. Full galvanized finish adds $1.00 net to the price. The standard unit weighs approx. 11 lbs., and excepting quantity orders is generally sent by parcel post or express.

Send for descriptive circular on this Safety Holder which was featured in the Electrical World "Operating Practices" article, pages 92 and 94, Feb. 8, 1941.

We have added this Safety Holder to our line of Through-bolt Guying Devices as the outstanding accessory for handling guy strand during construction, just as our Guy Hooks provide the outstanding pole attachment for the upper guy loop, made up in advance on the ground. These Guy Hooks, of which over one million units had been shipped into the field by the end of 1940, constitute the nucleus around which simplified guying specifications have been built by Companies constituting more than one-half the operating capacity of the U. S. and Canada. Resultant construction is unexcelled in economy and safety, and absolutely no reports of unsatisfactory performance have come back to us from the field. Use both M.I.F. Through-bolt Guying Devices and the Jenne Safety Guy Strand Holders for best results in guying construction.



Send for Samples and Descriptive Literature

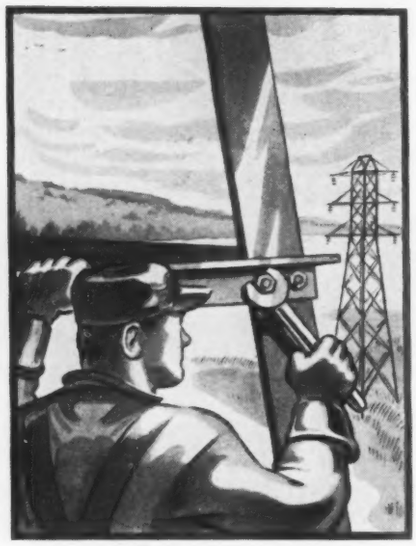
Misc. M.I.F. Pole Hardware Specialties: — *Williams Pole Mounts — Pole Stubbing Clamps — Aerial Cable Messenger Clamps and Insulated Hangers — Malleable Secondary Racks and Clevises — Tubular Pole Fittings — Transformer Hanger Plates for Through-bolt Mounting — Malleable Crossarm Gains — Screw Anchors — Sidewalk Guy Fixtures and Alley Arm Braces — Through-bolts and Double-arming Bolts, etc.*

MALLEABLE IRON FITTINGS COMPANY

Pole Hardware Dept. [Factory and New England Sales Office] **Branford, Connecticut**

New York Sales Office: Thirty Church Street

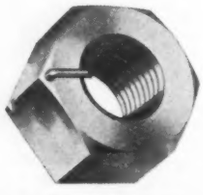
Canadian Mfg. Distributor: LINE & CABLE ACCESSORIES, Ltd., Toronto



Tight as an

ANCO-NUT!

If you've used them you know just how tight that is! They won't work loose because they can't . . . Anco-Nuts are put on the bolt in the ordinary way, and with an ordinary wrench they can be easily removed without damage to either the nut or the bolt . . . Nut and lock are a single unit . . . No washers, pins or other separate parts to be mislaid and forgotten during installation . . . Fool Proof—No matter how unskilled the labor . . . Comparable in price to the ordinary nut and lock washer, but incomparably more secure and efficient . . . They will prove indispensable where conditions of shock and vibration must be met, as vibration tends to tighten the locking—it can't unlock ANCO-NUTS.



ANCO-NUTS

fit any standard bolt and are furnished black or galvanized with U. S. S., S. A. E. or Whitworth threads as ordered. Write today for complete data and samples.

◆ ◆ ◆

AUTOMATIC NUT COMPANY

LEBANON, PA.

Allots $2,605,000 to Power Systems

Harry Slattery, Administrator of Rural Electrification, has announced allotments totaling $2,605,000 for rural electrification in eleven states. These allotments provide for the establishment of three new power systems, the enlargement of seventeen co-operatives and one public power district.

Details of the allotments follow:

ARKANSAS—Craighead Electric Co-operative Corp., Jonesboro, T. J. Robertson, manager, $206,000, to build 244 miles of line, 742 members in Craighead, Poinsett, Greene, Crittenden and Lawrence counties Arkansas Valley Electric Co-operative Corp., Ozark, Wallace M. Milton, supt., $271,000 to build 320 miles of line, 961 members in Johnson, Logan, Crawford, Franklin, Sebastian, Yell and Scott counties, Ark., and Leflore and Sequoyah counties, Okla. Woodruff Electric Co-operative Corp., Augusta, T. E. Bostick, asst. mgr., $170,000 to build 193 miles of line, 670 members in Cross, Woodruff, Monroe, Lee, St. Francis, Phillips and Prairie counties. Mississippi County Electric Co-operative, Inc., Blytheville, H. C. Knappenberger, supt., $56,000 to build 75 miles of line, 221 members in Mississippi and Poinsett counties.

IDAHO—Clearwater Valley Light and Power Assn., Inc., Lewiston, A. R. Mushlitz, supt., $128,000 to build 131 miles of line, 307 members in Lewis, Nez Perce, Clearwater, Latah and Benewah counties, Idaho, and Whitman County, Wash.

KENTUCKY—Green River Rural Electric Co-operative Corp., Owensboro, C. T. Smith, manager, $120,000 to build 135 miles of line, 405 members in Daviess, McLean, Ohio, Webster and Hopkins counties. Warren Rural Electric Co-operative Corp., Bowling Green, Lester Wright, supt., $100,000 to build 113 miles of line, 332 members in Grayson, Warren, Butler, Ohio, Edmonson and Simpson counties. Fleming-Mason Rural Electric Co-operative Corp., Flemingsburg, James K. Smith, supt., $97,000 to build 111 miles of line, 374 members in Nicholas, Greenup, Bracken, Mason, Montgomery, Elliott, Fleming, Carter, Robertson, Lewis and Bath counties.

MAINE—Denny River Electric Co-operative, Meddybemps, John C. Benner, president, $100,000 to build 95 miles of line, 365 members in Washington County. Union River Electric Co-operative, Inc., Aurora, William S. Silsby, president, $88,500 to build 78.5 miles of line, 362 members in Hancock and Penobscot counties.

MISSISSIPPI—Central Electric Power Association, Carthage, E. T. Thames, supt., $63,000 to build 98 miles of line, 371 members in Attala, Leake, Neshoba, Madison, Rankin, Newton and Scott counties. Tallahatchie Valley Electric Power Assn., Batesville, William H. Saxton, supt., $127,000 to build 104 miles of line, 464 members in Panola, Tallahatchie, Quitman, Grenada, Tate and Lafayette counties. Coast Electric Power Assn., Bay St. Louis, C. Clifton Ferrell, supt., $80,000 to build 95 miles of line, 324 members in Pearl River, Harrison and Hancock counties. Magnolia Electric Power Assn., McComb, G. H. Alford, supt., $157,000 to build 202 miles of line, 554 members in Amite, Franklin, Lawrence, Lincoln, Pike and Walthall counties. East Mississippi Electric Power Assn., Meridian, Grady W. Smith, supt., $51,000 to build 65 miles of line, 297 members in Lauderdale, Clarke and Jasper counties.

NEBRASKA—Cedar-Knox County Rural Public Power Dist., Hartington, Harold M. Martindale, supt., $45,000 to build 57.5 miles of line, 123 members in Cedar, Knox and Dixon counties.

NORTH CAROLINA — Edgecombe-Martin County Electric Membership Corp., Tarboro, J. T. Hagans, supt., $45,500 to build 55 miles of line, 195 members in Martin, Edgecombe, Nash and Pitt counties.

OHIO—Adams Rural Electric Co-operative, Inc., West Union, H. C. Brown, president, $228,000 to build 226 miles of line, 746 members in Scioto, Adams and Brown counties.

PENNSYLVANIA—Adams Electric Co-operative, Inc., Gettysburg, Calvin A. Cluck, supt., $100,000 to build 100 miles of line, 300 members in Cumberland and Franklin counties.

TEXAS—Bandera County Electric Co-operative, Inc., Bandera City, Tex., C. M. Wagner, supt., $308,000 to build 310 miles of line, 916 members in Bandera, Kendall, Kerr, Medina, Real and Uvalde counties.

WASHINGTON—Columbia County Rural Electric Association, Inc., Dayton, Oakley A. Kendall, supt., $64,000 to build 77 miles of line, 103 members in Columbia county.

•

New York Air Conditioning Shows Decreases for '40

Electric air-conditioning installations placed on the lines of Consolidated Edison Co. of New York, Inc., during 1940 numbered 1,267, totaling 17,925 hp., as compared with 1,569 installations totaling 18,817 hp. during 1939.

Included in the 1940 total were 1,389 self-contained air-conditioning units, totaling 2,673 hp.

•

Peoples Light Cited

Federal Power Commission has ordered that a public hearing be held on March 17 at Davenport, Iowa, and that at the hearing Peoples Light Co., a United Light & Power Co. subsidiary, show cause why it should not be ordered to adjust its accounts in conformity with recommendations contained in a commission's staff "Report on the Reclassification and Original Cost Studies of Electric Plant as at January 1, 1937", transmitted to the company on April 3.

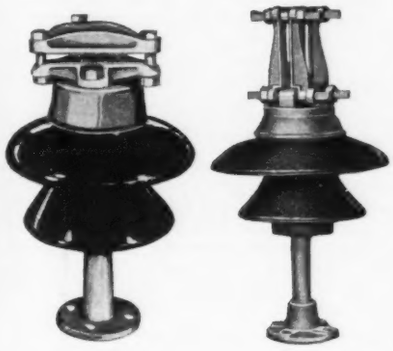
•

Light Rate Protested

In protest against charges of $4,000 a year by the Long Island Lighting Co. for street lighting service in Roslyn, Long Island, and against the renewal of a five-year contract on the same basis, Mayor Michael Hassett and the board of trustees have appealed to the New York Public Service Commission for a reduction of 30 per cent and other concessions.

Strong
CONSTRUCTION
FOR
Dependable
SERVICE

"THREE E"
FORM D
OUTDOOR
INSULATING
SUPPORTS



To simplify the matter of outdoor Insulating Support selection and to get the exactly right types for your particular needs, specify "THREE E."

This organization has designed and manufactured Outdoor Insulating Supports for over thirty years—today the line is complete and modern with always the right one to carry the bus you want, the way you want it carried.

We have Adapters for those who wish to run a bus at an odd angle to the supporting frame work.

This Adapter can be used with any "THREE E" Bus Support to service any position in a complete circle.

Form D Porcelain Units are made in strict accordance with the latest standards of the N. E. M. A.

WRITE FOR
BULLETIN NO. 271.

36 pages giving types, voltages, ratings, and dimensions in inches.

Electrical
ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

Electrical Modernity in a Paper Mill

[*Continued from page 50*]

capacity and moisture-resisting properties. Buried construction for these feeders was avoided as far as possible for maintenance reasons.

Other wiring in the mill consisted of moisture-proof, rubber-insulated or 30 per cent para rubber-insulated, double-braided cable in conduit, as influenced by the conditions to be met.

Synchronous motors have been installed on relatively large low-speed drives such as jordans, wood chippers, vacuum pumps and air compressors, as well as the large motor driving No. 1 paper machine m.g. set, to provide sufficient reactive kva. to bring the plant power factor up to about 95 per cent lagging.

A small gasoline-driven d.c. generator set has been installed for supplying emergency lighting current in the turbine and boiler plants, which automatically starts in the event of failure of generated or incoming power.

Owing to the wet conditions and chemical fumes existing in many sections of a pulp and paper mill the majority of the motors are of splash-proof type and special care was taken in the installation and wiring to meet these requirements.

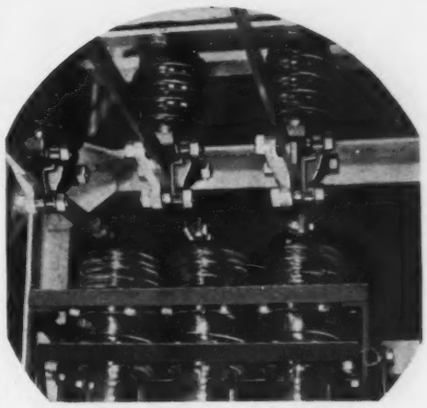
Motors, drives, carrier-current motor control and other electrical equipment in the mill are General Electric, with the exception of the 440-volt motor controls and load center assemblies, which are Trumbull.

•

Output Hits New High; Canadian Exports to U.S.

Output of central electric stations in Canada reached a new peak in 1940, the total being 30,080,248,000 kw.-hr., an increase of 6.1 per cent above the output in 1939, the Dominion Bureau of Statistics reports. Output during December totaled 2,584,341,000 kw.-hr. against 2,524,860,000 kw.-hr. in November and 2,536,242,000 kw.-hr. in December, 1939.

Exports to the United States during 1940 were 2,135,557,000 kw.-hr., against 1,912,633,000 kw.-hr. in 1939. Exports during December amounted to 199,866,000 kw.-hr., against 185,492,000 kw.-hr. the previous month and 150,138,000 kw.-hr. a year ago.



"THREE E"
INDOOR BUS
SUPPORTS AND
FITTINGS

for carrying any type of bus any way . . .

The "THREE E" complete line of Bus Supports up to and including 23000 volts are made for carrying horizontal or vertical bars and round conductors. "THREE E" engineers have been responsible for much of the pioneering and development of bus supports and have always made advanced design available—plus this, is strong construction. Fittings are made to meet every requirement.

"THREE E" Form E
Indoor Insulating
Supports

This line is recommended for heavy duty service in power houses and substations where high electrical safety is required and where the mechanical stresses, due to short circuits, etc., may run high. The parts are interchangeable. Write for Bulletin No. 125.

Bulletin 126 will give you complete data on moderate duty indoor bus supports and fittings—be sure to request a copy.

Electrical
ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

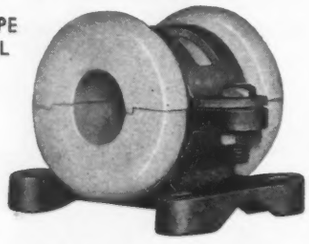
Practical
ECONOMICAL METHOD OF RIGIDLY SUPPORTING CABLES

Extremely flexible and can be turned in any direction with respect to its mounting

"THREE E"
Type CIL
CLAMP INSULATOR SUPPORTS

Made in flat or pipe mounting types. Single hole mounting is particularly advantageous where supports are to be mounted on concrete or similar surface. Flat mounting supports can easily be converted to pipe mounting. Metal parts as well as porcelain parts are interchangeable. Outside dimensions of small or large size porcelain spools are the same—hole sizes only change—this permits future increase in cable diameter by simple replacing of insulator spools with larger holes.

TYPE MIL



This type is intended for heavy duty service in power houses, substations, industrial plants, mills, mines, etc. Bases are of heavy malleable iron casting for 4-bolt flat mounting or 2 U-bolt pipe mounting. Metal and porcelain parts are interchangeable. Both MIL and CIL supports can be used with properly insulated cable of any voltage or with bare cable up to 600 volts. Write for Bulletin No. 200.

Electrical
ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILL.

Sales Opportunities

ENSLEY, ALA.—Birmingham Electric Co., Birmingham, plans new power substation in vicinity of Ensley, near Birmingham, including extensions in transmission lines in that area. Work is scheduled to begin soon. Cost estimated close to $200,000. This will be part of 1941 expansion program of company, for which a total fund of approximately $1,000,000 has been authorized for all divisions of operation. A part of this appropriation will be used for extensions in distribution lines and power substation facilities in downtown district at Birmingham.

DENVER, COLO.—Bureau of Reclamation, Denver, receives bids until March 10 for main station-service and station-power control equipment; generator-voltage bus structures; and quantity of metalclad switchgear for Parker hydroelectric power station, Parker Dam power project, Arizona-California. All equipment will be installed by Government (Specifications 952).

CLEVELAND, OHIO—Eaton Manufacturing Co., 739 East 140th Street, manufacturer of automotive equipment, plans installation of motors and controls, switchgear, duct lines, electric hoists, conveyors and other equipment for expansion in plant for production of airplane engine parts, propeller shafts, etc., for Government. Company will secure Federal fund of $1,250,000 for project, of which approximately $854,000 will be used for machinery and equipment purchases of all kinds for addition to main plant, location noted, on which superstructure has been placed under way.

MAQUOKETA, IOWA—City Council receives bids until March 11 for equipment for municipal power plant (bids previously received have been rejected) including a.c. electric generator direct-connected to diesel engine unit, exciter, air filter, pyrometer apparatus and complete auxiliary equipment.

ALBERT LEA, MINN.—Interstate Power Co., Dubuque, Iowa, plans extensions and improvements in steam-electric generating station at Albert Lea, including installation of new turbine-generator unit and auxiliary equipment for considerable increase in present capacity. Also will make extensions and improvements in transmission line between Albert Lea and Dubuque. Entire project is reported to cost about $1,900,000 and will form part of 1941 development program of company.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until March 4 for quantity of ammeters and voltmeters for Brooklyn, N. Y., and Mare Island, Calif., navy yards (Schedule 5360). Also, at same time for two motor-driven high-pressure and four motor-driven low-pressure air compressors and spare parts, for Eastern or Western navy yard (Schedule 5400); and, at same time, for 675 signal lights for Philadelphia, Pa., Sewall's Point, Va., and San Diego, Calif., navy yards (Schedule 5357).

BALTIMORE, MD. — Bethlehem-Fairfield Shipyard, Inc., organized recently as an interest of Bethlehem Steel Company, Shipbuilding Division, 1101 Key Highway, Baltimore, plans installation of transformers and accessories, switchgear, heavy-duty motors and controls, duct lines, industrial lighting apparatus, electric cranes and hoists, conveyors and other equipment in new shipbuilding plant at Fairfield, near Baltimore, for construction of vessels for United States Maritime Commission; company will take over former property of Union Shipbuilding Company at location noted and use as site for plant. Also, will install similar electric equipment in new steel fabricating plant at Curtis Bay, where former works of Pullman Standard Car Company are being acquired, to be modernized and expanded for this purpose. Entire project will cost about $7,838,000, in which amount appropriation will be arranged by Government.

PITTSBURG, CALIF.—Pacific Gas & Electric Co., San Francisco, Calif., plans power substation at plant of Dow Chemical Company, Pittsburg, for power supply for industrial service. Also will make extensions in transmission lines to that point. Cost reported close to $70,000.

FAIRBURY, NEB.—City Council has authorized purchase of voltage regulator equipment for Steele City power line. Guy Bell, city engineer, is in charge.

ROANOKE, VA.—Appalachian Electric Power Co., Roanoke, has authorized fund of about $675,000 for expansion and improvements in transmission and distributing lines, power substations and other operating facilities at Roanoke and vicinity, including rural electric lines. This will be part of 1941 expansion program of company.

PORTLAND, ORE.—Bonneville Power Administration, Department of Interior, Pittock Block, Portland, plans new overhead transmission line across Willamette River at Rock Island, vicinity of Oregon City, Ore., for Bonneville transmission system. Work will include steel towers to provide clearance of 125 feet above low water, heavy-duty type conductors and line fittings. It is understood that bids will be asked at early date.

LOUISVILLE, KY.—Louisville Gas & Electric Co. has approved final plans for new steam-electric generating station in vicinity of place known as Paddy's Run, on Ohio River, near Louisville, previously referred to in these columns, and will proceed with building construction at early date. Company has taken over tract of about 50 acres of land at location noted. Intial installation will include two 25,000-kw. turbine-generators and accessories, two high-pressure boilers and auxiliary equipment, with large outdoor power substation and switchyard adjoining. Award for generators has been made to Westinghouse Electric & Manufacturing Co., and for boilers to Combustion Engineering Co.; contracts for other equipment will be placed in near future. Plant is scheduled for completion in 16 to 18 months, and is estimated to cost close to $5,600,000. It has been designed for an ultimate capacity of 300,000-kw. Public Utility Engineering & Service Corp., 231 South LaSalle Street, Chicago, Ill., is consulting engineer.

TUSCALOOSA, ALA.—Alabama Power Co., Birmingham, plans early rebuilding of transmission line at Tuscaloosa and vicinity for 110,000 volt operation, instead of 44,000 volts, as heretofore, with increased line capacity at power substation. This will be part of 1941 line expansion program of company.

Utility Chooses Oilostatic Cable

[*Continued from page 42*]

sion tank is divided and each half takes care of one cable circuit. Each section has a separate gear pump that keeps the pipe line at 200 lb. pressure, electrically controlled. Should the static pressure, due to contraction of the oil, fall below 180 lb., the pump will operate. When load or weather conditions increase the temperature, the relief valves operate—at 210 lb.—and oil discharges back into the expansion tank.

Both halves of the expansion tank are tapped at the top for vacuum connection into a small vacuum pump which automatically keeps a vacuum above the stored oil and prevents oxidation. Cross-connections are provided in case one pump is out of order, so that pressure can be maintained with one pump. Pump operations occur from two or three a day to one in three days, for an interval of about one-quarter minute, frequency depending on system operating cycles, temperature conditions, etc. No provisions are made for reclaiming and filtering the oil; if it should be thought necessary, the oil can be drained through the pipes into tank cars and the entire body of oil replaced at one time.

Cable Thoroughly Impregnated

It is believed that the cable will continue to operate for some time even if oil is lost because of the intense impregnation secured through the 200-lb. pressure. The manufacturer reports that on one oilostatic installation an important circuit was operated for several hours with a major leak at a pothead whose base plate bolts had been sheared off through an accident.

During high-voltage tests on samples of the Burlington oilostatic cable made at 200-lb. pressure at the factory prior to installation a result of 1,256 volts per mil was secured without failure. (Tests were discontinued at this point since the apparatus was needed for other purposes.)

No electrolysis is expected to develop in the installation; nevertheless, test wires are taken off the pipe every 100 ft. to test for potential on the pipe or to put potential on.

An interesting feature is that when the installation was completed the

"RAGGED ARMIES"
(of electrical control equipment)
CAN'T WIN INDUSTRY'S EXPANSION BATTLES

TRUMBULL

But, look at these pictures of NEW Trumbull Motor Control Centers . . . standardized units that put together just like a kid's building blocks.

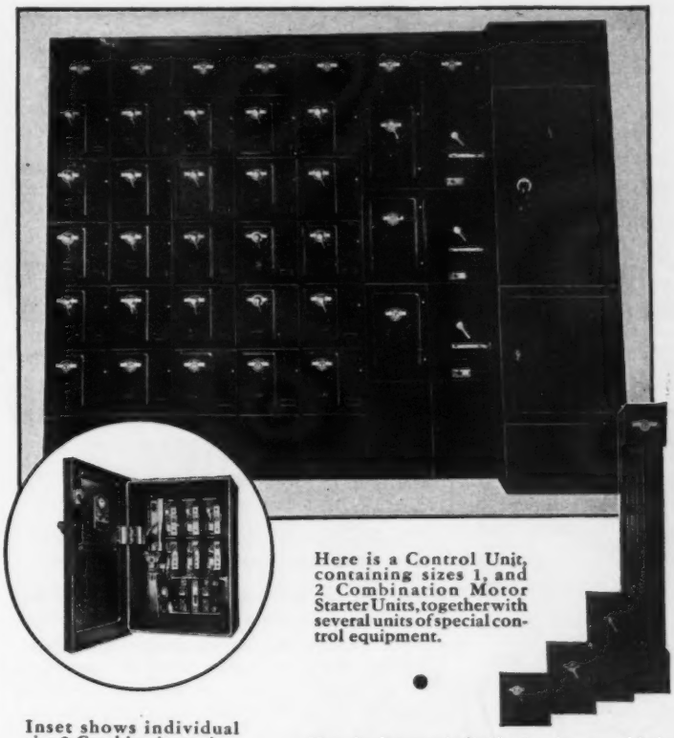
TIME-SAVINGS in ordering . . . installation . . . wiring and hook-up to machines.

SPACE SAVINGS, with trim, efficient, centralized control units, instead of a "ragged army" of unrelated equipment. Push-buttons, of course, for remote control from operating stations . . . perfect set-up for multi-motor machines.

FLEXIBILITY when you have to expand (or contract), relocate or change-over. Control units can be re-grouped in sections or sections re-grouped in the plant.

And think of the EASE of ordering these completely standardized control units for rapid installation.

Equipment like this will help solve your defense speed-up problems . . . and quickly open up electrical bottlenecks.

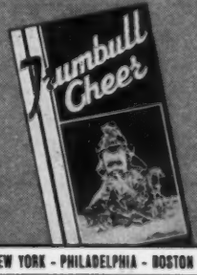


Here is a Control Unit, containing sizes 1, and 2 Combination Motor Starter Units, together with several units of special control equipment.

Inset shows individual size 2 Combination unit.

Here is the way individual units assemble in the section trough . . . 5 size 1; 3 size 2 or 2 size 3 motor starter combinations or all sizes assorted.

ESTABLISHED 1899
THE TRUMBULL ELEC. MFG. CO.
PLAINVILLE CONN. U.S.A.
A GENERAL ELECTRIC ORGANIZATION



KEEP *Alert* ELECTRICALLY
use your TRUMBULLAIDS

NEW YORK - PHILADELPHIA - BOSTON - CHICAGO - DETROIT - LUDLOW, KY. - ATLANTA - NASHVILLE - LOS ANGELES - SAN FRANCISCO - SEATTLE

This sign becomes effective only when property is protected by a Stewart Non-Climbable Chain Link Wire Fence. Stewart Fences assure continuous, dependable protection and exclusion of enemy agents. Next month may be too late—you need Stewart protection NOW! Send for Catalog No. 79. Sales and Erection offices in principal cities.

THE STEWART IRON WORKS CO., INC.
866 Stewart Block Cincinnati, Ohio

"Fence Builders to America Since 1886"

Stewart IRON and WIRE FENCES

70 MASTER-LIGHTS
for Better, Faster Night Repairs

High Power and Convenience to Increase the Efficiency of Your Line Crews

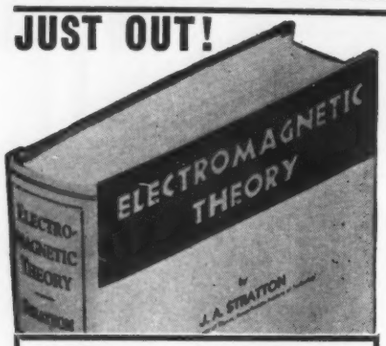
Type "T"

The most powerful automobile spotlight made. (Roof-type (Inside Pistol Grip Control). Range one-mile. Swings in complete circle, any angle, up or down. Penetrates fog or smoke. Operates from car battery. Best construction throughout. Chrome plated, polished, aluminum handle. No gears to wear or rattle. Rust and weather-proof.

● Type T, above, is but one of the 70 Master-Lights that help give your line and repair crews adequate light to speed up emergency jobs, end outages more quickly, retain customer goodwill. Types available include worklights, searchlights, floodlights, warning lights, patrol lights, watchman's light . . . and other lights for all conditions. 30-day free trial. Send for descriptive literature.

CARPENTER MFG. CO.
Master-Light Makers
167 Sidney St.
Cambridge, Mass.

JUST OUT!



ELECTROMAGNETIC THEORY

By Julius Adams Stratton
Associate Professor of Physics
Massachusetts Institute of Technology
612 pages, 6 x 9, illustrated, $6.00

Postulating Maxwell's equations at the outset, this advanced text and reference book on electromagnetic theory everywhere emphasizes the dynamic rather than the static aspect of field theory. A mathematical formulation of the general theory in the first chapter is followed by a comprehensive investigation of energy and stress relations. The properties of static fields are discussed in two chapters and the remainder of the book is devoted to the propagation of plane, cylindrical and spherical waves, the theory of radiation, and concludes with a study of representative boundary-value problems.

—provides the fundamental background necessary for a critical appreciation of original contributions in special fields
—shows the origin and limitations of important engineering formulas
—emphasizes dynamic rather than static field theory

CONTENTS

1. Field Equations
2. Stress and Energy
3. The Electrostatic Field
4. The Magnetostatic Field
5. Plane Waves in Unbounded, Isotropic Media
6. Cylindrical Waves
7. Spherical Waves
8. Radiation
9. Boundary-value Problems

Mail this coupon for
10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., INC.
330 West 42nd St., N. Y.

Send me Stratton's Electromagnetic Theory for 10 days' examination on approval. In 10 days I will send you $6.00 plus few cents postage or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

Address..... Position.....

City and State..... Company.....W. 2-22-41
(Books sent on approval in U. S. and Canada only.)

132 kv. was applied abruptly, rather than in progressive steps, as is customary with new installations in a developmental realm.

A second "Oilostatic" installation of similar characteristics is planned for the second unit of the station, now under construction.

Carrier Indicator Reports Rural Outages

[*Continued from page 54*]

operation. Since static impulses on the lines were found to be quite prevalent, both squelch and time-delay circuits were used to minimize any effects they might have on relay operation. The output circuit was designed to deliver d.c. voltage up to 100 volts for possible use on leased telephone lines. To it will be connected the tape-recording unit which was previously described.

It was realized that the receiver unit would require considerably more maintenance than the transmitters as a result of its continuous operation. Provisions were therefore made in the design easily to replace the chassis within the housing with a spare unit in order that the original one can be serviced.

Inexpensive

Upon completion of the proposed field tests it will be possible to design the final units incorporating the improvements indicated by this experience. The cost of these transmitter units is expected to be under $100. With this equipment installed it will then be possible to facilitate greatly the continuity of service on the system. This automatic indication of the line outage and some means of communication with the maintenance crew will make possible a rapid and efficient plan of restoring service, resulting in reduced operating costs, increased revenue and increased consumer good will.

●

Appliance Sales Up 40%

Dealers in the territory served by Virginia Public Service Co. sold a total of $2,729,219 of electrical appliances during 1940, an increase of about 40 per cent. The total included 1,826 ranges, 12,763 refrigerators, 599 water heaters, 5,259 washers, 170 ironers and 71 water systems. The average customer spent more than $30 for major appliances in 1940.

BUT PLAY SAFE

Specify MILLER "ANODE" GLOVES FOR GREATER SAVINGS and SAFETY

● Looking for a way to cut electrician glove costs without lowering your safety standards? Then Miller has the answer. Every glove in its line is made from pure latex by the Anode process. Result—a safer glove that withstands repeated electric tests, has high resistance to current leakage, and a longer wearing glove possessing greater tensile strength and unusual age resistance.

You pay no premium for these exclusive Anode qualities. First cost of Miller Electrician's Gloves is the same as ordinary gloves of equal specifications. They are available in a range of lengths and sizes for Class A or Class B service, in either the straight or curved finger design. Write for prices and descriptive literature now.

Straight Finger Design — Sizes 9, 9½, 10, 10½, 11 and 11½.

Curved Finger Design — Sizes 10, 10½, 11 and 11½.

MILLER RUBBER CO., Inc. AKRON, OHIO

"Engineers in Rubber"

Network Protector Operations Reduced

[*Continued from page 57*]

through a transformer. This minimizes the energy requirements and permits the use of thick, strong springs. A proper balance of mass, electrical energy and a restriction of heat-conducting paths give the element a time delay proportional to its contact travel. Consequently, the position of the stationary "hot" contact provides the only adjustment necessary to vary the operating time. Variations that might be caused by changes in ambient temperature are eliminated by mounting the stationary contacts on a second bimetal spring, below the heated spring.

All elements of the relay are sturdily constructed so that a minimum of servicing will be required. This claim is substantiated by approximately 30 relay-years of operating experience on the Boston Edison system.

Time Settings

In service it has been found that the use of time settings of from two to five minutes delay on all sensitive protector operations will eliminate practically all of the needless protector operations. This is particularly true in areas where frequent operations occur due to regenerative elevators which operate when the network is lightly loaded. If in unusual instances, where a continuous reversal of power is encountered during sytem changes, it is desired to maintain the protector closed, the timer can be interrupted (Fig. 2) by simply removing terminal screw No. 4. The protector will then remain closed when current of less than the setting of the overload elements flows continuously in either direction. A setting of this kind duplicates some of the earlier methods of controlling the network protectors, and in some instances can be used without sacrificing the over-all sensitivity of the control apparatus. This, of course, assumes that only one or two BN relays will be used on any one feeder and the sum of all the transformer magnetizing currents is larger than the sum of the over-current settings of those BN relays.

Experience and theory alike indicate that this new tool will serve to make network distribution systems even more reliable, and less costly, than in the past.

DID YOU KNOW

this costs no more

A cost-minded foreman figures it pays to use modern—

KEARNEY GUY WIRE CLIPS

FIGURE the time it takes to do a serving or mousing job the old way . . . Figure the damage of rust and corrosion caused by nicking galvanizing on the strands . . . Figure hazards of frayed or broken strand ends . . . Add them together and you'll find it pays to serve-up strand ends more safely and neatly by using modern Kearney Guy Wire Clips or Strand Bands.

Ask a Kearney Representative to show you this popular Clip or—place a trial order for real proof of money-saving advantages. Write James R. Kearney Corporation, 4236 Clayton Ave., St. Louis, Mo. *Canadian Plant,* Toronto, Canada.

The Mark of Quality Products

JAMES R. KEARNEY CORPORATION ST. LOUIS

UTILITY EQUIPMENT

for BETTER Construction

PROFESSIONAL SERVICES

Consulting
Accounting
Valuations

Management
Appraisals
Construction

Designing
Testing
Financing

Inspections
Cost Analysis
Investigations

N. W. ATTERBURY & CO.

Consulting Engineers

General Engineering Service

P. O. Box 1793 Pittsburgh, Pa.

E. T. L.

TESTS

Electrical, Chemical, Mechanical, Photometric

INSPECTIONS
Materials and Supplies

RESEARCH
Private Labs. for Clients

Electrical Testing Laboratories, New York, N. Y.

SANDERSON & PORTER

ENGINEERS
for the
FINANCING—REORGANIZATION—
DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES

Chicago New York San Francisco

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS

35 East Wacker Drive Chicago, Ill.

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

SPOONER & MERRILL, INC.

Consulting Engineers

Design—Supervision of Construction
Reports—Examinations—Valuations

20 North Wacker Drive, Chicago, Illinois

E. J. CHENEY AND CO.

Engineers and Consultants

61 Broadway New York

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers — Economists
Public Utility Management Problems
Economic Audits for Selective Load Building
Balanced Domestic Load Development
Cost Analysis—Rate Cases

30 East 42nd Street—New York

STEVENS & WOOD

Incorporated
ENGINEERS AND
CONSTRUCTORS

30 Broad Street New York

HUGH L. COOPER & CO.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

101 Park Ave. New York

J. H. MANNING & COMPANY

ENGINEERING
SERVICES

120 BROADWAY
NEW YORK

FIELD BUILDING
CHICAGO

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON • NEW YORK • CHICAGO
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

DAY & ZIMMERMANN, INC.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA
Packard Building CHICAGO

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

A. Y. TAYLOR AND COMPANY

Municipal and Industrial Consulting Engineers

Reports, Appraisals, Design
Supervision of Construction

2 So. Central Ave. Clayton, Mo.

ROBERT E. FOLEY

Erecting Engineer

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

ARTHUR L. MULLERGREN

Public Utilities Consultant

Management

Fairfax Bldg. Kansas City, Mo.

THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

FORD, BACON & DAVIS, Inc.

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York
Philadelphia — Washington — Cleveland — Chicago

Recording & Statistical Corp.

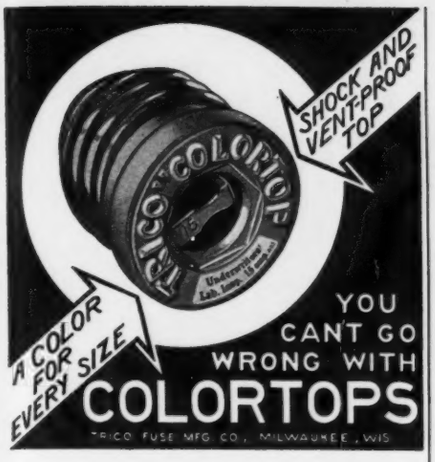
BILL ANALYSIS—CONSUMPTION STUDIES

THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services nationally.



HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

Contains ALL the ANSWERS!

4,000 plant listings . . . personnel . . . meters connected . . . exactly the data you need on central stations for analyzing sales territories, etc., plus quick reference for individual items. Order your copy of the McGraw Central Station Directory today.

$25.00 per copy

McGRAW-HILL PUBLISHING CO. INC.
330 W. 42nd Street New York, N. Y.

LETTER TO THE EDITOR

Competitive Side of Residential Load Mortality

To the Editor of ELECTRICAL WORLD:

I have read with considerable interest your editorial entitled "Residential Load Mortality Data," which appeared in the January 11 issue of the ELECTRICAL WORLD.

I am wondering if your conclusion should not be amplified just a little. Shouldn't the last sentence read: "So long as the services supplied by electricity are essential, *and the price for such services as water heating, cooking and refrigeration is dollar for dollar equivalent with that of the lowest cost by which these services can be replaced,* they can be expected to continue" (italics new.—ED.)

In my opinion, the fact that the price of electric service is competitive is the real crux of the situation. In the utility from which I think you took these figures this fact is true. In other words, if the customer were to supplant his use of electricity with some other source of heat and power it would be impossible for him to save any money. If the customer is to reduce his electric usage, it will be necessary for him to discontinue the use of hot water, cooking and refrigeration either entirely or to some appreciable extent.

I am just passing this along as a thought which comes to me after reading your excellent editorial.

H. E. DEXTER,
Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y.

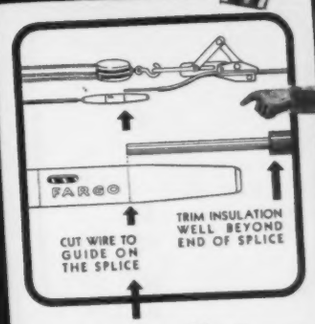
[The editorial closed on the point of essentiality because we do not believe residential usage will be maintained during hard times if the customers feel they can get along without any part of the service. That is one of the penalties utilities will face with the higher average consumptions.

We agree on the competitive angle with reservations. Undoubtedly the customer will replace electric services with others that cost less—provided the customer can afford to buy the equipment. It seems to us that there is the rub.

Coal and wood cooking may cost less than electric, but can the customer afford to buy a coal range—and if he can will the difference in cost of services offset the cost of the coal usage within a reasonable time?—ED.]

new

Sag Guide on FARGO LINE SPLICE shows you where to cut wire!



Another Fargo "first", new Sag Guide markings on the Fargo Line Splice show exactly how much conductor goes inside the splice. Result . . . you know exactly where to cut the wire to get the desired sag. Saves guessing, saves time.

And how that Fargo Splice *holds!* 4-jaw gripping unit of machined non-corrosive Everdur develops full conductor strength. Heavy, *all copper* shell of highest conductivity. Strong phosphor bronze spring. Full range of sizes. Specify FARGO, "the sure splice".

Made by Fargo Mfg. Co.
Distributed by

LINE MATERIAL CO.
MILWAUKEE, WISCONSIN

Flashboards Release Flood Like House of Cards

[*Continued from page 51*]

rod out of the U-bolt which clamps the end gate in closed position.

In designing the 18-in. top flashing a determination was made of the breaking strength of 2 x 4-in. creosoted native Southern pine stakes dressed on four sides to various reduced cross-sections. These are tabulated in the table in terms of various resisting moments and heights of pond surface above the tops of the 18-in. supplementary flashboards.

The swinging gates seal so well that the leakage is barely sufficient to moisten more than about one-tenth of the spillway behind them. When the top flashing is dry there is, of course, some leakage, but it is not appreciable.

This top flashing has broken away satisfactorily on six occasions since installation and the swinging feature has been taken advantage of three times without hitch.

•

Books Received

Electromagnetic theory. By J. A. Stratton. International Series in Physics advanced treatment of dynamic field theory, wave propagation, radiation in m.k.s. units. McGraw-Hill Book Co., New York, 615 pages, illustrated. Price $6.

Men and Volts. By John Winthrop Hammond. J. B. Lippincott Company, Philadelphia. 435 pages, illustrated. Price $2.50. The story of the evolution of General Electric is parallel with the pioneering that created the electrical art.

Electrical Engineering Laboratory Experiments. By C. W. Ricker and C. E. Tucker. McGraw-Hill Book Co., Inc., New York. 449 pages, illustrated. Price $3.

Storage Batteries, Third Revised Edition. By George Wood Vinal. John Wiley & Sons, Inc. 464 pages, illustrated. Price $5.

Steam-Turbine Principles and Practice, Second Edition. By Terrell Croft; revised by S. A. Tucker (Assoc. Ed. of *Power*). McGraw-Hill Book Co., Inc., New York. 298 pages, illustrated. Price $3.

•

Illinois Electric Sales

Total sales of energy to ultimate consumers by the eleven largest electric utilities in the state of Illinois amounted to 759,688,302 kw.-hr. in December, 1940, as compared with 680,950,306 kw.-hr. reported for the same month of 1939. This is an 11.6 per cent increase in sales. Comparison of December's sales with those for November, 1940, reveals an increase of 5.5 per cent.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A. M. Monday will appear in Saturday's issue, subject to limitations of space available.

POSITIONS VACANT

LIGHTING ENGINEER WANTED, qualified to design and recommend suitable lighting and fixtures for large installations. Applicant should be engineering graduate, preferably with special training in this field. Knowledge of fixture market and lighting standards is essential. Application should cover experience in detail and salary desired. Location Southern Atlantic State. P-862, Electrical World, 330 W. 42nd St., New York, N. Y.

TRANSFORMER ENGINEER, experienced in design and construction of transformers. Give complete details first letter. P-873, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 positions may contact employers through our confidential services, established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

COYNE ELECTRICAL SCHOOL GRADUATE age 23 for Electrical Maintenance, trouble-shooting, Repairing on all types Industrial Equipment including Switchboards and operation. PW-860, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

MAN age 36. With 16 years experience in Hydro Power Plant Engineering. 5 years with U. S. Government. Wants position as Engineer or assistant to Engineer in Municipal or Power Company or Manufacturing Company. Will take job anywhere. It must be regular work. PW-865, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER licensed, experienced in power plant, substation, transmission and distribution design. Familiar with operating problems of all. Now employed desires change. PW-866, Electrical World, 330 W. 42nd St., New York, N. Y.

OPERATING MANAGER: Capable and able to take complete charge of system:—generation, distribution, rates, accounting, and general engineering. 13 years of diversified electric and water experience. E.E. graduate, G.E. Test Course. Now employed. PW-867, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRIC UTILITY EXECUTIVE. Graduate M.E., age 42, 20 years experience with two companies including supervision central stations, Electric transmission system operation, distribution, water and bus departments. Understand related labor and management problems. Employed. Desire change for greater responsibility. References. PW-857, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRIC UTILITY EXECUTIVE and ENGINEER with diversified, balanced operating experience production, transmission distribution, design, construction, sales, purchasing, public relations. Age 38. Excellent record employee relations. Fully capable as executive assistant, supervisor general or specific operations, or utility engineer with financial institution. Now employed. PW-869, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER, with 12 years experience in design of large hydro- and steam plants, competent to take charge of wiring and Switchboard design for generating stations, now employed, desires change. PW-870, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

POSITIONS WANTED

E.E.B.S. with advanced mathematics and physics; 27, married, employed; four years experience in research and development; desire position with manufacturing company where advancement is possible. PW-871, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

TRAVELING AUDITOR supervisory experience. Twelve years in public utility work. Address PW-872, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

FACTORY WORKER, (Master Electrician) all around experience, inspector on electr. and radio parts, tester, adjuster, assembler, Blueprints read; Ambitious, inventive and adaptable; hard worker. Basch, 108 West 76th St., N. Y. C. SUsquehanna 7-9719.

OFFICIAL PROPOSALS

(See opposite page)

Reputable Business Executive

Desires connection as Southwestern Distributor

Able to furnish necessary bonds.

Box 1552, DALLAS, TEXAS

WANTED

WANTED: Watthour meters, etc.

D. C.—G. E. Types C, C-6, C-7, C-9, C-12 & C-15 West. Type CW-6—Sangamo & G. E. Demand Meters Rotating Standards, resistance cages & testing equipment.

A. C.—Single phase (115 volt 2 wire) & polyphase meters: West. Types O.B., O.C., CS-3, CA-3, etc. Sangamo Types HC, HF, HFA, L2A, L2½, LC2, etc. G. E. Types I-16, I-20, I-18, D-15, V-4-A, etc. Testing equipment, phantom loads, volt & ammeters, etc.

W-868, Electrical World, 330 W. 42nd St., N. Y. C.

"SEARCHLIGHT"

IS

Opportunity Advertising

—to help you get what you want.
—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want

"THINK SEARCHLIGHT FIRST"